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Issue #272

73®

Amateur Radio's Technical Journal

International Edition

A Wayne Green Publication

Annual Antenna Issue!

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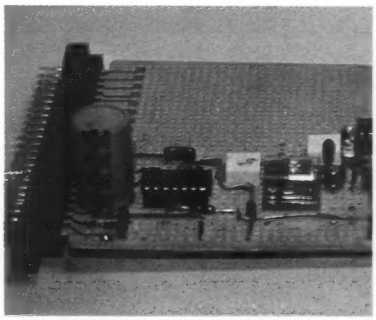

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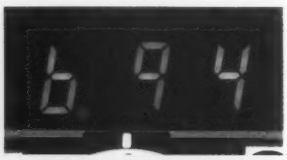

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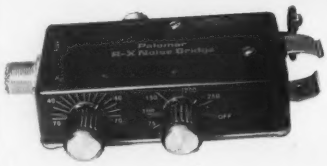

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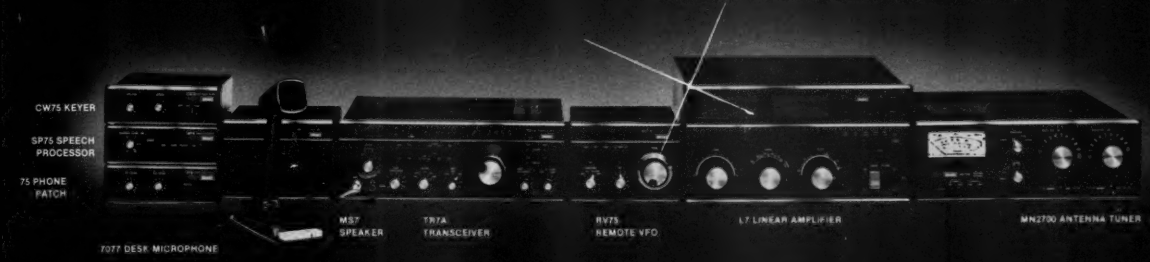

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W2NSD/1
NEVER SAY DIE
editorial by Wayne Green

BREAKING LOOSE

One of the difficulties about trying to explain amateur radio to friends is the wide variety of hobbies which make it up. The general public, if it has any image of amateur radio at all, tends to think of it as a bunch of kids talking to people around the world from their attic or cellar ham stations. In some respects, this isn't far short of the mark . . . we *are* kids, having one hell of a lot of fun. And a fair percentage of us are in there working DX.

Not so well known to the public are the tens of thousands of us talking with each other through repeaters from our mobile stations or hand-held rigs. And virtually unknown are the thousands of us who are mixing computers and amateur radio over the air, working via ASCII, packet radio, and RTTY, or are into such fascinating aspects as SSTV, facsimile, satellite communications, low-band DXing, VHF DXing, meteor bounce, aurora bounce, and so on.

Indeed, I'd venture to guess that there are tens of thousands of hams who are missing out on much of the fun and value of amateur radio just because they are off stuck in some corner, perhaps spending the remaining days of their lives rag-chewing on 75m or being alternate net control on some nightly net.

The monthly infusion of excitement from *73* helps to break up these gradually hardening patterns of life. By publishing articles on the fun of some new aspect, it gets dozens more broken loose every month. You can help with this process, making amateur radio more fun and of more value to both hams and our country. You can do this by writing articles on an activity you are involved with which you think should be enjoyed by more amateurs. You can do it by trying out some new aspect of the hobby and talking to your friends about it . . . talking it up at the ham club.

Building some new gadget is a ball. Not only is it a challenge to do, but when you get through you have something to show to your family and ham friends. No, you don't want to try to build a synthesized sideband transceiver from scratch. But you might want to try your hand at something easier, such as one of the small construction projects in *73* each month.

Over 60,000 hams have expanded their interest in amateur radio to include computers, with the result that a growing number are getting on the air and making high-speed computer-aided CW contacts, computer-run RTTY contacts, and so on. Further, a surprising number have taken their newfound computer interest and escalated it into a small business . . . with many going from tiny part-time efforts to million-dollar-size businesses.

The world is heading toward a major communications change. This means that amateurs have an opportunity to be in the vanguard of the change . . . or, as for the last twenty years, they can hang back, keeping alive the spirit of the 30s more than the 80s. It is surprising, and disappointing to some, how few real changes have been made in the last fifty years of hamming. Oh, the time was when new modes of communications were invented and pioneered by hams. We did a pretty good job of this with sideband thirty years ago and with FM and repeaters fifteen years ago. But even these technology changes have made little impact on the old-time ham . . . so far. Indeed, a ham going through time from 1933 to 1983 and tuning the ham bands would find it difficult to tell that 50 years has passed.

When one looks at the possibilities which we have with the technology already at our command and then looks ahead a few years to see what we might be able to develop, the prospects are exciting. Repeaters are okay, buy why not start linking them up via remote controls so they can relay, probably via 450 MHz or even 1200 MHz, so longer-range contacts can be made easily? And how about setting up some low-band links via repeaters? Now that the FCC says they are going to stop restricting our experimenting, it is time for us to get cracking.

The day isn't far off, if we get moving, when we will be able to have local repeaters route contacts via other central repeaters, then up via a satellite such as Telstar using space commercial channels and back down again anywhere in the country, again routing from a central satellite link to a local repeater, and out. Granted, we won't be able to do a lot of voice communicating via such links, but once we get the hang of RTTY and ASCII communications, we'll be able to zip messages around almost anywhere in the world.

The new message-boy satellite will get us used to sending messages up to a repeater, having them stored there for drop as the satellite circles to some other part of the world . . . picking up traffic for us perhaps over Bangkok and dumping the message as the satellite goes over North America again a few hours later.

Sure, you're going to have to start getting some new equipment. You're going to have to start building some of it, too. And the secret to all of this is in your monthly magazine, which will keep you in touch with the other people experimenting with new techniques and services. I really feel sorry for the ham who is so dead that he doesn't get *any* ham magazines . . . and would you believe that over half of the licensed hams read no ham magazines at all? If you know someone like this, try to get an issue of *73* into his hands, even if only overnight. Let him see the wide variety of simple construction projects which he could have fun with . . . the excitement of getting onto RTTY or slow scan. A brain without stimulation turns to garbage . . . check the bands and see if I'm not right.

Talk up the magazines over the air; get fellow hams into reading 'em. Sure, the magazines seem expensive at $25 per year, but put that into perspective. Remember that deluxe cars were only $500 a few years ago. Modern presses have kept the cost of magazines down substantially, with the main cost these days being the postage, which has gone up beyond belief.

As a continuing source of state-of-the-art information, there is no substitute for magazines such as *73*. If you want a lot of club news with a few technical articles, you've got *QST*. If you want contest info, you've got *CQ*. If you're hot for super-complicated contruction projects, there's *HR*. For articles on lots of gadgets you can build, info on the latest in RTTY, ASCII, SSTV, and other new developments, thorough coverage of FM and repeaters, and also the best international coverage, there's *73*. The main aim of *73* is to make amateur radio more fun.

THE ASCII INRUSH?

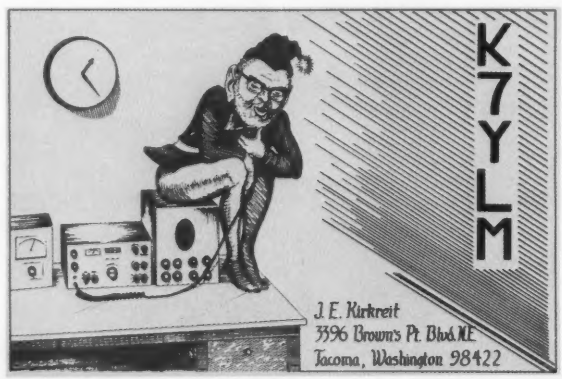
Considering the growing number of contraptions to interface computers and ham rigs, we may be able to get some interest in joining the ham ranks by computerists. Now, with computers costing under $50 (the Timex TS-1000 is reported to be $59.95 at Osco Drugs, less a $15 Timex rebate) and with a projected sale of well over two million computers for 1983, we may be developing a large untapped source of hams who will go for a digital communications system.

Tell you what, if you'll start writing some articles on the amateur radio use of computers and submitting them for publication, I think I can get our computer magazine editors to give this movement a push. Articles on using the TRS-80 systems will obviously be routed into *80 Micro*. Those which are Apple-based will go to *inCider*, our new Apple magazine. Those which are based on other systems will probably be aimed at *Microcomputing*.

By the way, in case you're interested, *inCider* got off to a fine start with the January issue and has, so far, been growing even faster than *80 Micro* did when we launched it back in 1980. *80* is running 400-500 pages a month these days and is still growing nicely, with around 300,000 regular readers. By the time we add the readers of the three magazines together, we reach about 700,000 computerists each month. If we only interest 10% of them in trying amateur radio, that'll be the biggest jump in new hams in over twenty years.

Mind you, I'm not looking for a one-shot promotion. When we started pushing FM and repeaters, we didn't get that moving with one or two articles. It took hundreds of them, backed up with books, FM symposiums, a monthly repeater newsletter, and so on. So we'll be needing articles on the fun of ASCII communications, articles on the use of all of the gadgets now on the market, construction projects for rolling your own, words on how to do digital via OSCAR, and info on how to set up repeaters so they can handle a second digital channel as well as voice relaying, how packet radio works, how to use the coming messenger-boy satellite, and so on.

We need articles on using all of the low-end computers for ham communications. There's the VIC, the T. I. 99/2, 99/4A, and 40, the Timex TS-1000 and new 2000, the Atari 400, 800, 1200, and coming 600, the Jupiter



QSL OF THE MONTH

This month's winning QSL comes from Jim Kirkreit K7YLM in Tacoma WA. The munchkin curled up on top of the radio is a caricature of Jim, and it was originally a pen-and-ink drawing by an inmate incarcerated at the federal prison where Jim worked. The drawing depicts "what he thought I looked like when I was transmitting," Jim said. But, "I must be honest," he added, "I usually don't operate while sitting on top of the rig."

If you think your QSL card is a winner, put it in an envelope with your choice of a book from *73*'s Radio Bookshop and send it to *73*, Pine Street, Peterborough NH 03458, Attn: QSL of the Month. Entries without an envelope or book choice will not be considered.

R-600

"Now hear this"...digital display, easy tuning

The R-600 is an affordably priced, high performance general coverage communications receiver covering 150 kHz to 30 MHz in 30 bands. Use of PLL synthesized circuitry provides maximum ease of operation.

R-600 FEATURES:

- 150 kHz to 30 MHz continuous coverage, AM, SSB, or CW.
- 30 bands, each 1 MHz wide, for easier tuning.
- Five digit frequency display, with 1 kHz resolution.
- 6 kHz IF filter for AM (wide), and 2.7 kHz filter for SSB, CW and AM (narrow).
- Up-conversion PLL circuit, for improved sensitivity, selectivity, and stability.
- Communications type noise blanker eliminates "pulse-type" noise.
- RF Attenuator allows 20 dB attenuation of strong signals.
- Tone control. • Front mounted speaker.
- "S" meter, with 1 to 5 SINPO "S" scale, plus standard scale.
- Coaxial and wire antenna terminals.
- 100, 120, 220, and 240 VAC, 50/60 Hz. Selector switch on rear panel.
- Optional 13.8 VDC operation, using DCK-1 cable kit.
- Other features include carrying handle, headphone jack, and record jack.

Optional accessories for R-600 and R-1000:

- DCK-1 DC Cable kit. • SP-100 External Speaker.
- HS-6, HS-5, HS-4 Headphones.
- HC-10 Digital World Clock.

R-1000

High performance, easy tuning, digital display

The R-1000 high performance communications receiver covers 200 kHz to 30 MHz in 30 bands. An up-conversion PLL synthesized circuit provides improved sensitivity, selectivity, and stability.

R-1000 FEATURES:

- Covers 200 kHz to 30 MHz.
- 30 bands, each 1 MHz wide.
- Five-digit frequency display with 1-kHz resolution and analog dial with precise gear dial mechanism.
- Built-in 12-hour quartz digital clock/timer.
- RF step attenuator.
- Three IF filters for optimum AM, SSB, CW.
- Effective noise blanker. • Tone control.
- Built-in 4-inch speaker. • Dimmer switch.
- Wire and coax antenna terminals.
- Voltage selector for 100, 120, 220, and 240 VAC. Operates on 13.8 VDC with optional DCK-1 kit.

TS-130SE

"Small talk"...IF shift, Processor, N/W switch, affordable.

A compact, all solid-state HF SSB/CW transceiver for mobile or fixed base station, covering 3.5 to 29.7 MHz.

TS-130SE FEATURES:

- 80-10 meters including the new 10, 18, and 24 MHz bands. Receives WWV on 10 MHz.
- TS-130SE runs 200 W PEP/160 W DC input on 80-15 meters, 160 W PEP/140 W DC on 12 and 10 meters. TS-130V version at 25 W PEP/20 W DC, all bands, also available.
- Digital display, built-in.
- IF shift circuit.
- Speech Processor, built in.
- Narrow/wide filter selection on CW and SSB with optional filters.
- Automatic SSB mode selection (LSB on 40 meters and below, USB on 30 meters and up). SSB reverse switch provided.
- RF attenuator, built-in.
- Effective noise blanker.
- Final amplifier protection circuit assures maximum reliability. Output power is reduced if abnormal operating conditions occur. For very severe operations, optional cooling fan, FA-4, is available.
- Dimensions: 3-3/4 H x 9-1/2 W x 11-9/16 D (inches). Weight: 12.3 lbs.
- Other features: VOX, CW semi break-in with sidetone, one fixed channel, and 25 kHz marker.

Optional DFC-230 Digital Frequency Controller
Frequency control in 20-Hz steps with UP/DOWN microphone (supplied with DFC-230). Four memories and digital display. (Also operates with TS-120S, TS530S, and TS-830S.)

Optional accessories:

- PS-30 matching power supply (TS-130SE).
- KPS-21 power supply (TS-130SE).
- PS-20 power supply (TS-130V).
- SP-120 external speaker.
- VFO-120 remote VFO.
- FA-4 fan unit (TS-130SE).
- YK-88C (500 Hz) and YK-88CN (270 Hz) CW filters.
- YK-88SN (1.8 kHz) narrow SSB filter.
- AT-130 antenna tuner.
- MB-100 mobile mounting bracket.

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Ace, the Panasonic JR-200, the two new Sanyo computers, and so on. Experimenters will undoubtedly make improvements on the commercially-available interfaces, which means more articles.

Then we need to get cracking on 1200 baud and higher speeds, working out the kinks of high-speed digital communications through QRM, QRN, fading, and so on. We need to seriously tackle the problem of error-correcting. If we are going to do any relaying of digital communications, each step in the relay must be error-corrected before the relay is continued. And we're looking at developing systems which will perhaps relay from a transceiving keyboard to a repeater direct to a second party, or perhaps via a relaying system through several more repeaters, or even a satellite or a low-band link. . . each step with error-correcting. Yes, we need a lot of experimenting. I think we're going to have more fun with all of this than anything else we've ever done in amateur radio.

In the meantime, let's start with what we've got and get going. Get your computers communicating over the air and write articles. . . which in turn will get more people playing around and incite manufacturers to turn out more interfaces for us. The secret to getting anything moving is to get the word spread around. Remember that FM and repeaters were being enjoyed by only a few hundred hams until I started making a big deal about it in *73*, and after that we managed to develop a whole industry around this activity. With computers and amateur radio I think we can get new blood into our hobby and have more fun than we have had in years.

WHAT COMPUTER?

A recent poll of *73* readers showed that over 37% already have some sort of microcomputer and about 80% are interested in 'em. The question which gets asked several times a day of any computer owner by friends is, "What computer should I get?"

With almost 300 different makes of desktop computers, one would think that a truly objective answer to that question would be impossible. After all, with over 400 different computer models being made, how can any one person know what really is best. . . and from what viewpoint?

Fortunately, the answer isn't anywhere near as complex as it would at first appear. Oh, I suppose if someone was interested in buying a small computer for one specific application and was absolutely positive that it wouldn't be used for anything else, the choice could get complicated. But the facts of life are clear: No matter what application someone has in mind when they get a computer, it isn't long before the uses of the system are expanding almost beyond control.

Perhaps I can state one basic rule of the computer field: Whatever you buy, it will merely be the beginning of a long string of purchases as you expand your system. There is no known limit to this.

But to get back to an attempt to answer the question of what computer system it would be best for you to buy. Before I name names, which I will, I've been around the darned things ever since they were invented, so I have a fair perspective on 'em. . . one which is not particularly colored by self-interest, though it may not give that impression.

The value of a computer system lies in three factors. Each of the three, I regret to say, appears to be of equal importance. They are, simply, the hardware, the software, and the instructions. Well, big deal, you may say. Yep, it is, and you'd better read on before chalking that up to just one more platitude.

To give a horrible example before I go into details on what I'm writing about, a very nice little portable computer arrived a few weeks ago for review by our staff. We got it out to a reviewer and after he had finished with his report, I asked to have the computer brought to my office so I might have a chance to work with it. It looked great and came with some powerful programs ready to use.

A couple of hours later I was almost screaming in frustration. I couldn't get *anything* to run on the damned thing. Oh, the disks would start up and the prompt appear on the screen, but nothing I could discover would get a program into operation. And, yes, I tried to use the instruction book. What a terror that was! I've been around microcomputers for seven years now and I couldn't make anything out of the instructions. Nothing anywhere in the manual explained how to put in a disk and get a program running.

Experienced computerists will be provoked with me for my anger. . . pointing out that *most* computers come with these big fat, almost useless books of instructions. The manuals are filled with computer scientist jargon, not simple how-to-do-it information. The sorry fact is that few equipment manufacturers provide much of value in the way of operating instructions for their gear. . . and that goes for software firms, too. This may help to explain why system-specific magazines such as our *80 Micro* grow so rapidly in circulation and size when they are announced.

Let me put this bluntly: If you opt for a computer system which is *not* supported by a magazine, you are going to lose much of the value of having a computer. The system-specific magazines serve several purposes, all of importance to you. First, they provide you with a continuing source of information from other users on how to get the most from your computer. In that respect, the magazine is like an enormous users group. Until you start getting one of these magazines, you may find it difficult to understand how much there is to be learned about your computer and how important it is for you to get this constant update.

A second value of such magazines lies in their use as a medium for the manufacturers of accessories, the publishers of programs, and the publishers of information about the system to reach you with their wares. Many of these firms are small and, without such a magazine, they would never even have a chance to get started since the several thousand computer stores have no way to seriously deal with hundreds upon hundreds of small suppliers. Being small, you'll often find some remarkable bargains via these firms.

A third benefit of your system-specific magazines lies in the wealth of programs which are published in each issue. *80 Micro* often has 20-40 programs listed in an issue, ranging from home programs to business, educational, simulations, scientific, and so on. These are available from some magazines in machine-readable form so you don't even have to sit there for two weeks typing in the listings. We have *Load 80* for *80 Micro* readers, either on cassette or disk.

Another benefit, and not a little one, lies in the discounts you'll find in these magazines. The buyer of a Radio Shack TRS-80 Model III system can often save up to $1,000 on a complete system by buying through some of the discount houses advertising in *80 Micro*. Even on one of the color computers, you may be able to save around $400 on a system, according to the editors of our new magazine, *HOT CoCo*, due out soon.

If you do decide to get a system which is not supported by a healthy system-specific magazine, you are going to have to make do with a minimum of help, support products, software, and discounts. Good luck, buddy. It's a route I would never recommend to anyone.

Okay, what systems are supported by such magazines? Well, there are several magazines for the TRS-80 computers, with *80 Micro* being the largest and best read by a wide margin, running from 400-600 pages a month. The Apple system is supported by several magazines, with our new one, *In-Cider*, already having the largest paid circulation in the field. That's self-serving, granted, but it is also the plain truth.

The IBM system is supported by a growing number of magazines, starting with *PC*. This is almost entirely a business-oriented system, so I'm not sure how much you may want to horse around with it. The Apple and TRS-80 have turned out to be of much greater interest to hobbyists, and so we are seeing a wider range of interesting uses. Still, the IBM does have strong magazine support. Beyond that you are in shallow waters. Commodore has effectively discouraged third-party publishers from doing anything for their computers by putting out their own in-house magazines, but these are so self-serving that they are of little value. Ditto most of the other such efforts. Osborne announced his own magazine supporting his system, but I've seen nothing beyond the first issue, so perhaps that fell through. They would do better to encourage a third-party publisher than to do it themselves. Apple has their own magazine, but slick as it is, it doesn't do much to help the Apple owner. Ditto the Radio Shack in-house magazine, which seldom has anything of much interest or value, or much material, and positively no discount ads.

Are you beginning to get the idea that this is coming down to a recommendation that newcomers to computers can expect to get into a lot of trouble if they go any route other than Apple or the TRS-80? Well, that's the way it seems to me. Remember, too, that because we have had these magazines providing communications between small firms and the users, we've had an incredible number of good programs developed. Firms don't put a lot of money into writing and publishing programs for systems where it is hard to reach the users.

The Timex-1000 computer is so cheap it is ridiculous. . . and it *is* a good computer. But the instructions which come with it will drive you up the wall, and good luck getting any help from any other source. With the system selling through a nearby drug chain for $59 and a factory $15 rebate, one could hardly find a cheaper computer. It's a marvel at that price, but only if you know what you are doing and don't mind the lack of instructions.

The VIC-20 is down to $150 via mail order, I see, though I think the firm selling it at that price may be connected with Commodore in some way. But even at that price, and considering the value of the computer, unless Commodore decides to get out of the publishing business and work with a third-

Continued on page 106

ARTICLES WANTED

For *73*, we need articles on: RTTY/ASCII construction projects, mods of commercial RTTY/ ASCII interfaces, computer ham applications, error-correcting developments, packet radio equipment and activities, digital communications via ham satellites, advanced repeater services and equipment. For our computer magazines, we need articles on the use of ham bands for computer communications.

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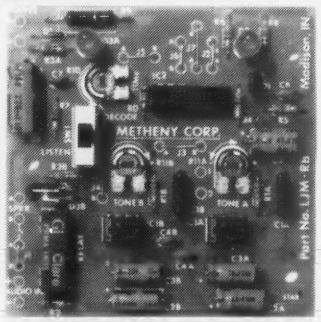

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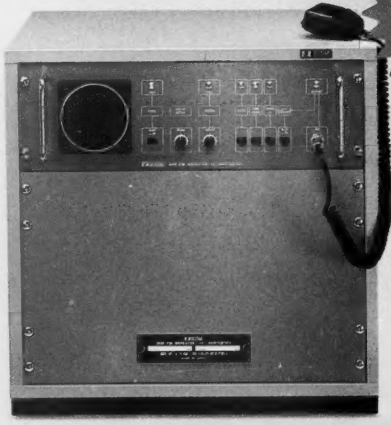

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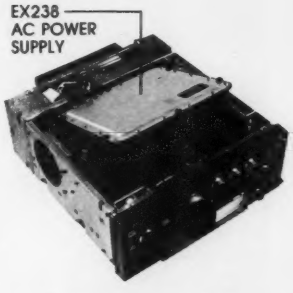

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Construct This Classic Transmitter

From the era of the tube comes this ageless design, runner-up in 73's Home-Brew II Contest. It's perfect for a first project or as a backup rig.

There are only two reasons you'll want to copy this little rig: It won't cost much and it's a lot of fun to build and use. This one-tube, crystal-controlled, 15-Watt oscillator is a copy of the type of transmitter built by thousands of hams in the post-WWII years as a first rig. Operating on 80 and 40 meters, it will load into practically anything and can provide solid contacts over distances of up to several hundred miles and even an occasional bit of real DX.

Collecting the parts and building the unit is half the fun. As can be seen in the photographs, the construction technique (true to the nature of the originals) could best be called free-style breadboard! With the exception of the tube and two old-style broadcast receiver tuning capacitors, most of the parts came from a discarded black and white TV chassis. While it's conceivable that all of the parts could be purchased new (for about $30), you'd be making a mistake if you did so. This is a low-pressure, easygoing junk box project, a strictly-for-fun test of ingenuity. Rummage around in the basement, ask your neighbors about their attics, visit your fellow hams—and above all, enjoy yourself!

Parts are cheap at Joe Ham's Curbside Parts Emporium! This TV chassis provided 80% of the transmitter's components.

A Touch of History

In the 1950s, it was much more common than it is today for a ham to build some major piece of station equipment. One reason is that the surplus market was flooded with inexpensive radio parts. Another is that up-to-date ham equipment, particularly for transmitting, was a lot simpler then. Crystal frequency control was common, and a CW transmitter, even one in the several-hundred-Watt class, was often just an oscillator driving one or maybe two paralleled output tubes. With no vfo, mixers, gang tuning, or even bandswitching (use plug-in coils!), the transmitter could be a pretty simple affair.

When the Novice license was created in 1951, it required the use of a crystal-controlled transmitter of less than 75 Watts input power and consequently the one-stage power oscillator became a popular home-brew item. The output obtainable from a crystal oscillator is limited primarily by the power sensitivity of the tube used and the amount of rf current the crystal can handle before fracturing. Some of those war-surplus crystals were pretty rugged, but even the smaller FT-243 quartz blanks worked fine with the sensitive tubes being developed for the postwar radio and TV boom. Single-tube oscillators soon were common on the 80- and 40-meter Novice bands, and gradually some really memorable designs emerged from the crowd.

One of the cheapest ham transmitters ever sold came out in 1960—the Ameco ATC-1, a one-tube 6V6 oscillator selling in kit form for less than $20. It was rated at a full 15 Watts input on 80 and 40 and came complete with all tubes, a crystal, and even a punched chassis! Perhaps the cleverest example of cheap and simple transmitter construction is a design from the 1950 *ARRL Handbook* which takes full advantage of a feature then common in commercial receivers. Perhaps as a hold-over from the days when vacuum tubes were very expensive, many of the receivers of that time had the audio for driving headphones taken from a low-level stage so that the big

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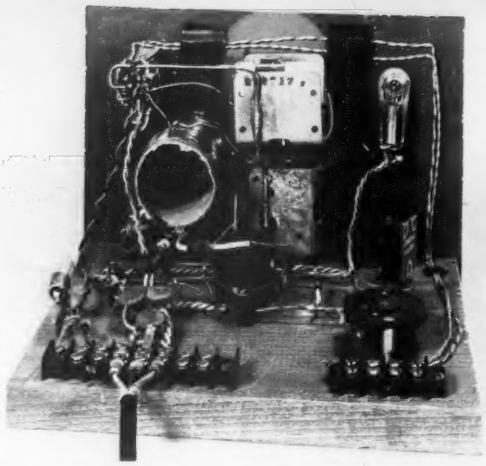
The front panel is dominated by the tune and load controls. The wide-range-output circuit will load power into practically anything.



Behind the attractive front panel the layout is true breadboard. Not pretty, but simple and effective. The single tube plugs into the center socket; the two on the right are for crystals. Wires taped across the top of the panel are receiver antenna and power leads.

audio-output amplifier was really used only with the speaker.

Once resigned to using the headphones only, the amateur could unplug the unused audio tube and build his transmitter around it—perhaps using some handy orange-crate slats for a chassis. A short cable and an octal plug fashioned from the base of a carefully-broken tube would then allow the transmitter to draw its filament and B+ power from the receiver's power supply: out of the same socket that previously held the output tube! No whining in those days about the high cost of ham equipment!

Noncritical Circuit—Easy To Copy

The "1950s Special" described here runs between 10 and 30 Watts input depending upon the tube type and power-supply voltage used. Output power ranges from 3 to 15 Watts, and that's plenty for making lots of solid contacts, particularly if a good antenna system is used. The circuit shown in Fig. 1 will work with a 6L6, 6V6, or 6K6 tube. While those tube types are common (they were popular for use in the audio stages of TVs, radios, and phonographs), the circuit is so noncritical that just about any power pentode in the 10-to-20-Watt class will work if the socket wiring is arranged to suit the tube pinout.

The oscillator itself is the grid-plate circuit familiar to anyone who has studied for the FCC amateur exam. The output circuit is a pi-network chosen for its ability to match a wide range of loads and simultaneously provide a high amount of harmonic rejection. Unlike the modern "no tune-up," solid-state equipment, this transmitter will load up into almost anything—even the proverbial damp string. A single-pole double-position slide switch adjusts the pi-net for either

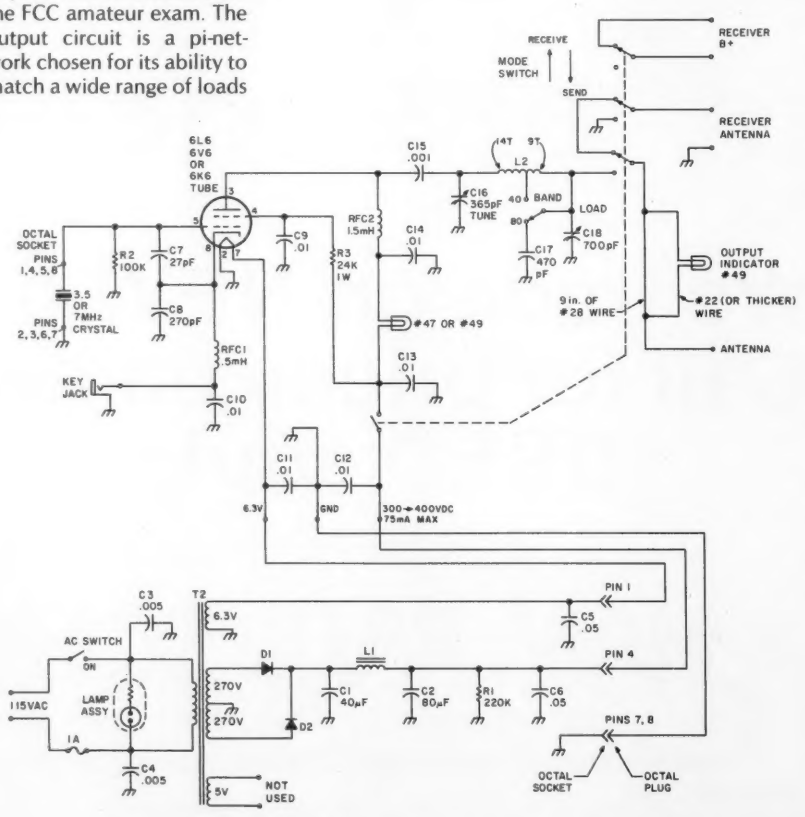


Fig. 1. Schematic of the one-tube transmitter and its power supply.

MESSAGE PROCESSOR TERMINAL

MPT3100

Message processing is now available for radio communications systems. The MPT3100 is a complete up-date of the popular HAL DS3100 RTTY terminal, adding the ability to store RTTY messages, edit them, and retransmit them singly or in preset groups. ALL of the previous features of the DS3100 and MSO3100 are retained and new mailbox commands are included. The editor may be used with any file that is stored. The MPT3100 includes ASR (Auto Send-Receive), MSO (Message Storage Option - "mailbox"), and TRO (Traffic Relay Option) modes. The MPT3100 is a new software package that works in ANY DS3100 with MSO3100 circuit board. Some of the features of the MPT3100 are:

NEW FEATURES OF MPT3100:

- Automatic storage of all received text in files separated by the standard "NNNN" terminator (TRO-REC mode)
- Full editing capability of all files stored by mailbox (MSO) or by TRO storage
- Editor allows insertion or deletion of text in any part of a stored message - 15 keyboard edit commands
- Editor may be used even while receiving, transmitting, or storing messages - even when MSO mailbox is in use
- Files may be renamed, created in the editor, cut into smaller files, and deleted with keyboard commands
- Message files may be transmitted singly or in batches
- Transmitted messages may be serial-numbered automatically
- The full format requirements for NAV MAR COR MARS NTP-8(A) are supported
- New TRO commands include: RXON, RXOFF, DIR, SEND, STOP, RESUME, RESTART, EDIT, CUT, CREATE, QUIT, RENAME, DELETE
- On-screen status indicators show: TRO mode; bytes of memory remaining; file names being recorded, transmitted, and edited
- MSO mailbox .SDIR directory command revised to shorten time required for transmission
- New .DIR [filematch] and .SDIR [filematch] mailbox commands give listing of only file names that include [filematch]
- Programmable "header ID" for each mailbox transmission

MSO Mailbox Features:

- Programmable MSO call-up command
- Mailbox may be controlled by external station to store message files, read files, delete files, and list the file directory
- DS3100 operator may perform all MSO operations on the keyboard without transmitting
- Mailbox transmissions include user-prompting and automatic CW and RTTY indentification
- HELP messages are provided to assist the new user in operation of the mailbox
- All mailbox messages stored may also be edited, renamed, and transmitted using TRO commands
- MSO commands are: .DELETE, .DIR, .DIR [filematch], .ENDFILE, .FILEHELP, .HELP, .KY1ON/OFF, .KY2ON/OFF, .PRINTON/OFF, .QBF, .READ, .RYS, .SDIR, .SDIR [filematch], .WRITE

DS3100ASR Terminal Features:

- Send and receive ASCII, Baudot, Morse codes
- ASCII or Baudot at 45, 50, 57, 74, 100, 110, 134, 150, 300, 600, 1200, 2400, 4800, and 9600 baud; full or half duplex
- Morse code at 1 to 175 wpm
- Full length 72 character line / 24 line screen display.
- 50 line pre-type on-screen transmit buffer
- True "ASR" operation - pretype transmit text while receiving
- 150 line receive display buffer
- MSO 3100 adds 32K bytes of additional storage
- 12 inch, P31 green display built-in
- Control functions are clearly marked on keytop
- On-screen status indicators with real-time indication
- Upper-lower case ASCII with ALL control codes
- Current loop or RS232 RTTY input/output
- Positive and negative Morse key outputs
- ASCII printer output prints Baudot, Morse, or ASCII text
- Operates on 105-130 / 210-250 VAC 50-400 Hz power

WHEN OUR CUSTOMERS TALK, WE LISTEN—and we have been listening. Rather than making a proven product obsolete—a product that is well known and respected for its reliability and capabilities—HAL has completely rewritten the software of the DS3100 to offer the features that our communications customers have been asking for. A full year in the preparation, these are features that could only be designed by people who know and operate RTTY. Best of all, ANY DS3100 can be modified at the factory to include the MPT3100! In marked comparison to other radio equipment that is made obsolete by new models every 6 to 12 months, the DS3100 lives on—a full 4 years after its announcement.

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BOX 365
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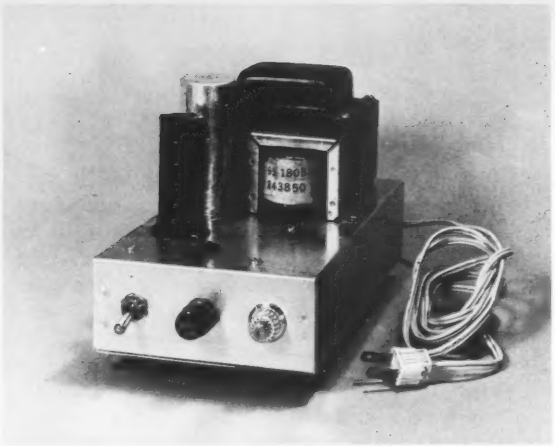
If you are really serious about your RTTY, look to HAL, your REAL RTTY company.

Please write for even more details about the MPT3100 Message Processor Terminal. Call your dealer or HAL for prices and how to get a new MPT3100 or to arrange for modification of your present DS3100.

↙See List of Advertisers on page 114



The separate power supply is built almost completely from TV-set components. Neatly built, it doubles as a useful general-purpose power supply.

80- or 40-meter operation, and a panel lamp in series with the plate power lead makes a cheap and effective replacement for the usual milliammeter.

In a similar vein, a second lamp is used as an output-power indicator in a version of the "Poor Ham's Variable Rf Ammeter" (see Fig. 2). This circuit is a real classic—the bulb is shunted across a portion of the antenna lead with the distance between clips determining the drive to the light. This surprisingly sensitive indicator is thus easily adjustable for a wide range of impedance and power levels. The dimensions given in Fig. 1 are suitable for loads of around 50 Ohms, and the more flexible arrangement shown in Fig. 2 can be used if necessary with random-length endfed antennas.

The only unnecessary frill added to the circuit is a 4PDT lever switch used to control the transmit-receive switching of the transmitter and its companion one-tube receiver (more on that later). The ac switch on the front panel is not used, for reasons explained shortly.

The power supply is built as a separate unit. This isn't strictly necessary, but I wanted to build the transmitter on a real breadboard, and for safety's sake an enclosed metal chassis is required for the power supply. Another important consideration is that the supply can then be used on other projects in the future.

One nice feature of the older TV receivers is that they usually have a power transformer instead of the series filament string "ac-dc" type of setup. These transformers provide for 6-volt filaments and about 275 volts on either side of a center tap—perfect for a small transmitter. If you have a choice, look for a black and white set because of its smaller (and lighter) transformer. Some of the older color sets have power transformers more suitable for 500-Watt linears than 15-Watt oscillators! In any case, the power transformer and filter components of my supply all came from Joe Ham's Curbside Parts Emporium (see photograph).

Real historical honesty would require the use of a vacuum rectifier tube, but I cheated slightly and used a more modern pair of TV-set silicon diodes; they are smaller and cooler than the tube. Feel free to use whatever you have or can get the easiest, however. After all, that's what this project is all about.

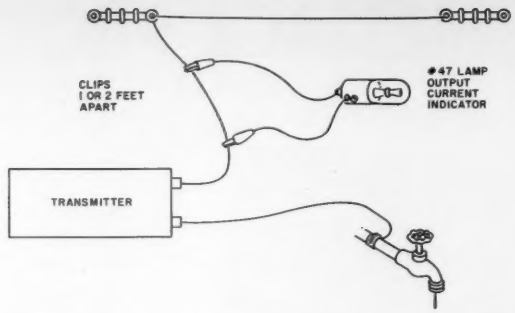


Fig. 2. Poor ham's variable rf ammeter as used with endfed antenna system.

What About TVI?

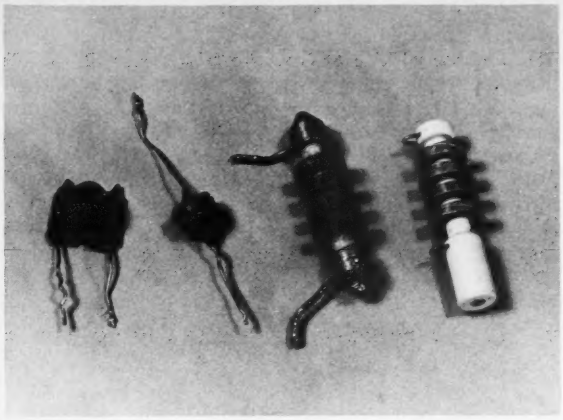
Old-timers who remember breadboard-style transmitter construction also will remember the TVI problems which contributed to the use of the metal chassis, pi-networks, and coaxial cable. There are two reasons why TVI is not a big problem with this transmitter: (1) Its low input power keeps any harmonics that much weaker to begin with, and (2) the pi-network does an excellent job of filtering the antenna output. While the signal reaching the antenna is pretty clean, the grid circuit of the oscillator is rich in harmonics and direct radiation from the transmitter wiring may be a problem. In my case, the transmitter, when operating on 40 meters with the 6L6, produces noticeable cross-hatching on channel 5 when the TV and transmitter are in the same room. The sets next door are completely unaffected, as is my own TV when it's moved to the garage 75 feet behind the house.

Operation on 80 meters is TVI-free, and several simple precautions can reduce the local 40-meter problem. Using the lower-power 6V6 or 6K6 tubes helps considerably. A proper balanced dipole is better than a random-length endfed wire antenna since less rf gets accidentally coupled into the house wiring, plumbing, etc. Harmonic generation and radiation also are reduced significantly if the plate-tuning control is adjusted slightly to the low-frequency side of the peak-output point.

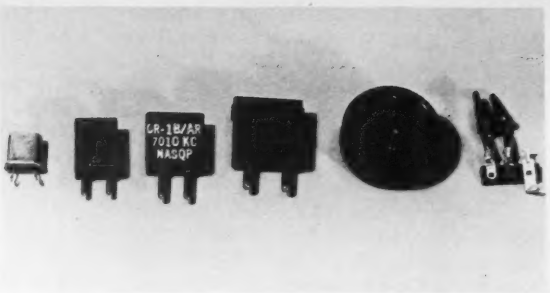
TVI is an unsavory subject to bring up in a transmitter construction article, but the issue should be faced. Interference is not a real problem with my set, and I took no particular precautions against it during construction. If you live in a crowded apartment complex, however, it might be wise to build the transmitter on a metal chassis. Placing all the grid-circuit components under the chassis and then screwing on a metal bottom plate will go a long way towards preventing even the minor TVI I observed.

Construction Tips

I built my transmitter on a 7" × 8¼" pine board which is ⅞" thick. A 6" × 8½" piece of 1/16" aluminum serves as the front panel and mounting support for many of the components. The several tube sockets are screwed to the board using ¾"-long wood, plastic, or metal spacers as standoffs. Newer hams may not know the trick of using an octal socket for crystals: The popular FT-243 holders will plug in nicely. I wired my socket as shown in Fig. 1 so that a crystal can be plugged in any pair of holes and still make proper electrical contact. Some of my crystals are real old-timers and have oddly-sized pins. To accommodate these, I also added the



The standard 2.5-mH rf chokes (the right-hand pair) are nice to use if you can get them. Several TV-style chokes (left-hand pair) in series will work just as well in this low-power circuit.



Second-hand crystals come in many sizes—all of them useful! Many hams prefer the standard FT-243 holders (second from left) which means that the others are cheaper to buy. The "universal crystal pin-grabber" (far right) will hold any of them.

old-style 6-pin tube socket visible in the photograph. In a pinch, even a *real* crystal socket would work!

Much of the rf circuit and ground wiring is done with thick copper house wire with the insulation stripped off. Many of the smaller components are supported simply by soldering them to these heavier bus wires. Use insulated wire for the high-voltage-dc circuits though, and make an effort to minimize the amount of exposed conductor in the plate and screen circuits. *Be careful to choose a socket for the panel lamp which has both contacts insulated from ground.* Some sockets automatically ground one side of the bulb—a real health risk in this application. My lamp socket has a pretty red jewel, but, to be honest, I usually look at the bulb by peeking over the top of the panel.

The power and antenna wires connect to the transmitter through an old-style barrier strip mounted on the rear of the board. Those wires could just as well be soldered to several salvaged TV terminal strips if you don't have the screw-type connector. My transmitter has a panel-mounted ac-power switch to control the external power supply. This isn't a good idea because the 115 volts gets exposed on the rear terminal strip. I never used the switch for anything, and the front-panel space would have been better utilized as a mounting place for the crystal socket. That also would remove the temptation to reach behind the panel and change crystals while the B+ is applied.

For the sake of historical authenticity, the plate-circuit pi-network coil is wound on a cardboard tube salvaged from a roll of toilet paper. These tubes aren't as sturdy as they used to be, and it was necessary to give this one several heavy coats of varnish before it was stiff enough to take the winding tension of the wire without collapsing. The coil requires about 12 feet of #20 wire. Solid hookup wire is ideal, but wire salvaged from the secondary of an audio-output transformer or deflection yoke will work fine, too. Of course, just about any of the commercial air-wound coil stock could be used, but there is a lot to be said for the thrill of building as much as possible of this rig with your own hands!

To wind the coil, first punch several small holes about ¼" apart near each end of a 3" section of the cardboard tube. Clamp one end of the length of wire in a vise and stretch the copper out by pulling on the far end to get it straight and kink-free. Thread the end through one pair of holes on the form leaving a 6" tail for the coil lead and then wind the 23 turns on the form as you walk towards the vise. If the coil is wound too loosely it will not hold its shape; too tightly, and the cardboard tube will collapse. After winding, thread the end wire through the other pair of holes and then spread the turns out to evenly cover about two inches of the form. When it looks as neat as possible, the turns can be fixed in place by running several beads of model cement down the length of the wiring. At first, I mounted the coil in the transmitter using only the leads for support. That wasn't stiff enough with the soft wire I had used, so I added a few drops of glue to steady it against the back of the front panel.

The plate- and load-tuning capacitors were salvaged from old broadcast receivers. The tuning capacitor is a single 365-pF section while the loading capacitor has two sections in parallel to total about 700 pF. When the bandswitch is in the 80-meter position, an additional 470 pF is added to the loading capacitor. That won't be necessary if you can scare up a tuning capacitor with three or more sections totaling 1000 pF or more.

Old-fashioned pi-wound rf chokes are a rare item these days, but fortunately a suitable substitute can be found in many old TV sets. The TV chassis I salvaged for parts had four small single-section chokes in it. Their inductance values ranged from .5 to .8 mH, so several placed in series make a good replacement for the old 2.5-mH standard. The transmitter requires two chokes, and at first I used two 2.5-mH units from my junk box. That worked fine, but I found by experiment that the transmitter worked just as well if a single TV choke was used in the cathode circuit and the three remaining units were series connected in the plate circuit.

The biggest problem in collecting parts for this little transmitter is finding some crystals, and the only economical solution is to get them from other hams. It's been years since low-band crystal control was popular, but hams rarely throw anything away. Any amateur flea market is likely to turn up someone with a box full of ham-band crystals priced at not more than fifty cents apiece. Twenty-five cents is a good price, but try offering the fellow a buck and a half for the whole box. If the flea market doesn't pan out, talk to some of the older fellows in the local club. Don't be afraid to buy old-style crystals in odd-looking holders (see photograph); they work

fine and make interesting additions to your collection of rocks.

No sockets for them? Try old-style tube sockets or—as a last resort—use a couple of alligator clips on the end of some stiff pieces of wire and build a "universal crystal pin-grabber" into your transmitter. As a final solution to the crystal procurement problem, you can always use the 3.579-MHz burst crystal from a junked color TV set. The biggest trouble there is that every color set in the neighborhood is radiating energy on that frequency and you may have to put up with a lot of unnecessary interference in your receiver.

I built this transmitter for use with the one-tube regenerative receiver described in "The Tube Returns" (*73*, December, 1982). To make combined operation easier, the transmitter send-receive switch incorporates some features which aren't strictly necessary. The minimum requirement is for a transmit-standby switch which opens the transmitter B+ line on standby. Having an old 4PDT lever switch, I wired it so that, in addition, it (1) connects the antenna to the receiver on Receive, (2) shorts the receiver antenna input on Transmit, and (3) opens the receiver B+ line on Transmit. Depending upon your needs and resources, you can add any or all of those extra functions.

The front panel was finished off with gray paint and press-on lettering—very unauthentic for a 1955 replica. My excuse is that the salvaged panel was already painted and scratched up from its previous use. Don't feel that you have to apologize to anyone if your version features unfinished aluminum and penciled-on control labels. Many of the original one-tubers didn't even *have* a front-panel—just parts mounted on a board or inverted cake-pan chassis!

The separate power supply is pretty conventional in circuit and layout. My collection of parts fits nicely on a 5″×9″×2″ chassis. The power transformer, filter capacitors, choke, bypass capacitors, and miscellaneous hardware were all salvaged from the TV chassis shown in the photograph. A full-wave rectifier using two TV power-supply diodes is mounted on a terminal strip under the chassis. Any diodes rated at more than 800 volts and 1 Amp will work fine, as will any of the common rectifier tubes (5Y3, 5Z3, 5V4, 5U4, 5R4, etc.). A bottom plate covers the under-chassis wiring for safety and neatness.

If you have trouble finding a real chassis, you can always use an inverted baking pan—the bread-pan size should be about right. For a bottom cover use a piece of board cut to fit tightly just

Parts List

Preferred values are shown on the schematic; a usable range of substitute values is given here.

C1, C2	20 or more uF at 350 or more working volts
C3, C4	.001 to .01 uF, 400 V or more
C5, C6	.001 to .1 uF, 400 V or more
C7	10 to 56 pF
C8	220 to 390 pF
C9-C14	.001 to .05 uF, 400 V or more
C15	.001 to .01, 600 V or more
C16	Single section of broadcast variable, 365 pF
C17	390 to 680 pF
C18	2 or more paralleled sections of broadcast variable, 700 pF or more total
D1, D2	1 Amp or more, 800 or more piv (TV rectifier diodes)
R1	220k to 470k, 1/2 Watt
R2	100k to 470k, 1/2 Watt
R3	22k to 39k, 1 Watt (may be 2 parallel 1/2-Watt resistors)
L1	TV power-supply choke (Typically 1 H at 350 mA) or any choke rated 1 H or more at 75 mA or more
L2	23 turns, 2″ long, 1-5/8″ diameter, #24 or heavier wire, tapped at 9 turns. Turns and dimensions may vary by +/− 20%
RFC1	.5 to 2.5 mH, TV set rf chokes in series
RFC2	1.5 to 2.5 mH, TV set rf chokes in series
T1	TV power-supply transformer. 220 to 325 volts ac on each side of center tap at 50 mA or more, and 6.3 volts at 1 Amp or more

BUYING PARTS

Readers living in truly remote parts of the US or on isolated Pacific atolls may genuinely not be able to scrounge parts, so here is a list of mail-order suppliers for the major transmitter components:

• Fair Radio Sales, 1016 E. Eureka St., Lima OH 45802 (1982 Catalog).

Power transformer	cat. no. TB1RX03LB/FGC-29	$5.95
Filter choke	cat. no. TF1RX04LB/FGC-29	3.95
6L6 tube (unused! but not new)		3.00
Octal sockets (2-hole mounting, 3@35¢)		1.05
		$13.95

• John Meshna and Sons, Inc., PO Box 62, East Lynn MA 01904 (Catalog #23, Spring 1982).

3 broadcast tuning caps (ask for AM style)	cat. no. SP-117	$1.00
40-meter crystal (choose 1 freq: 7.025, 7.050, 7.075)		1.00
10 1-mH rf chokes		1.00
Filter capacitor	cat. no. MC-6	.25
6 slide switches (SPDT)	cat. no. SW-103	1.00
10 ceramic disc caps (ask for eight .015 1 kV, one 22 pF, and one 270 pF)		1.00
3 key jacks	cat. no. H-38	1.00
3-Amp, 1000-piv diodes (2@45¢ each)		.90
3 indicating fuseholders	cat. no. SP-30-21	1.00
		$8.15

Meshna has a $10 minimum order; you might want to write for their catalog first and see what else looks good.

• Radio Shack (1982 catalog).

Barrier strip	274-670	$1.39
Knobs (2)	274-407	1.29
Alligator clips	270-380	1.19
1.5-A fuses (3)	270-1274	.59
470k, 1/2-W resistors	271-042	.19
47k, 1/2-W resistors (parallel for R3)	271-042	.19
#47 lamps (2)	272-1110	.69
6-V, 60-mA lamps	272-1144	.99
		$6.52

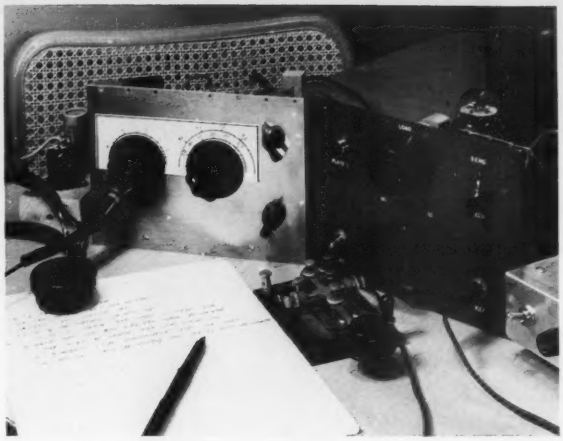
Total project cost: $13.95 + 8.15 + 6.52 = $28.62. With a little effort put into scrounging parts, the actual cost should be something under five dollars. If your immediate circle of friends fails to produce a suitable TV set, remember that many supermarkets have bulletin boards where "want" notices can be posted at no cost. And don't overlook the possibility of putting a want ad in the local newspaper. Something like this should produce results: Old TV??—I'll Haul it Away Free! Experimenter desires donations of old working or non-working TVs and radios for educational project. Let me help clean your cellar!

inside the bottom opening and secured in place with wood screws. Don't forget to include an ac line fuse even if you have to buy the holder. My supply is good for 375 volts at 200 mA or so, and 6.3 volts at 3 or 4 Amps. The transmitter will draw at most 75 mA of B+ current and less than an Amp at 6.3 volts.

Tuning Up

Before actually discussing tune-up, let's discuss safety. There are high voltages exposed on the components and wiring of this transmitter. That's easy to forget in these days of transistor equipment and 12-volt power supplies. Remember that the high voltage is there, and remember that the filter capacitors will stay charged for some time after the ac is turned off. Watch your fingers! Watch out also for small children or pets when you're using this rig. This little transmitter is a lot of fun to use but don't let an accident zap your enjoyment.

With only two controls, tuning up doesn't take much time. The procedure is basically the dip-and-load operation used with most tube-type transmitters. Connect an antenna or dummy load (a 7- or 10-Watt, 115-volt bulb works fine as a dummy), plug in a key and crystal, and turn on the power. Eighty-meter crystals will work on 80 or 40 by the way, but the output power is cut almost in half when the transmitter is doubling, so 40-meter crystals are recommended for that band. Set the loading capacitor to maximum capacitance, hit the key, and rotate the tuning capacitor until a dip in plate current is reached somewhere around the middle of the capacitor's range. As always, minimum plate current (as indicated by a drop in the brightness of the plate-current indicator bulb) corresponds with maximum power output.



The complete two-tube station, ready for action. The 6SN7 receiver was described in the December, 1982, issue of 73. This simple and inexpensive setup can provide solid contacts over hundreds of miles on the 80- and 40-meter bands.

There are several peculiarities of this circuit which will be observed. Tuning the output network also affects the oscillator portion of the circuit, so the dip is not always as sharply defined as it would be in a plain amplifier-output stage. If the output is tuned too far below resonance, the oscillator will quit entirely and the plate current will jump to some high level. The desired dip is found at a plate-tuning setting just a little on the low-capacity side of the point where the oscillator starts. When the transmitter is fully loaded, the dip is sometimes hard to observe on the plate-current bulb and the output-current lamp will then provide a better tuning indicator.

Operating Hints

The best way to initiate a contact with this little rig is by calling CQ. Practically everyone else on the band will be using a vfo and super-selective receiver, so unless the other station just happens to be very close to your crystal frequency, the chances of making a contact by answering a CQ are poor. A good antenna will always help, and having several crystals for each band is also an asset. Last but not least, don't let the low power level discourage you. In the last ten years there has been quite an upswing in QRP activity, and many hams operate entirely with power outputs lower than that offered by this one-tuber. Remember that at the distant receiver, 10 Watts is only about an S-unit and a half weaker than 100 Watts!

I've been using the one-tube transmitter as a companion to my one-tube regenerative receiver. Like the transmitter, the receiver was built with the goal of duplicating something a 15-year-old Novice might have constructed around 1955. Together, the two pieces of gear make a nice matched station and have provided many enjoyable hours of air time.

The receiver has plug-in coils which provide plenty of bandspread on both 80 and 40, but operation has mostly been on 80 meters during the early evening hours. Forty meters at night is just too big a challenge for the receiver, although several daytime contacts have been made on that band without difficulty. Eighty is an ideal band for this type of equipment: The lack of interference, strong stable propagation, and slightly better receiver performance all contribute to long and enjoyable contacts.

The biggest practical problem is spotting the transmitter's crystal frequency with the receiver. Presumably, this wasn't as much a bother in the old days—contacts just didn't always occur on one frequency as they do now. I solved the spotting problem by cheating a little: A weak test signal is generated by plugging the crystal into a simple transistor-oscillator circuit. Perhaps some reader can suggest a more authentic spotting procedure.

Relax and Enjoy

One of the amazing things about ham radio is its great variety. Equipment can't get much cruder than the station described here: a 40-year-old circuit design using obsolete salvaged parts and hand-built with carpenter's tools. Yet this set can provide reliable communications over hundreds of miles. Most impressive of all is that more often than not when I exchange signal reports with that distant ham and his $1200 transceiver, I give him the same RST 579 he honestly gave me! (I make it a habit to get a signal report *before* I describe my equipment—that avoids the "sympathy vote.") You'll also find that nothing seems to get past the standard hello/good-bye contact habit faster than a description of this two-tube ham station. Often I can almost see the tears in the other fellow's eyes as he tells me about similar equipment built and operated in the dim past.

I'd be the last to claim that you can set the band on fire with this little transmitter, but I will promise that it's an almost zero-cost source of great entertainment. Discover (or rediscover) for yourself the flavor ham radio had in the days before passband tuning and digital readout. Build it—and enjoy it! ■

MFJ ANTENNA TUNERS 16 MODELS

MFJ-941C 300 Watt Versa Tuner II

Has SWR/Wattmeter, Antenna Switch, Balun. Matches everything 1.8-30 MHz: dipoles, vees, random wires, verticals, mobile whips, beams, balanced lines, coax lines.

Ham Radio's most popular antenna tuner. Improved, too.

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Fastest selling MFJ tuner . . . because it has the most wanted features at the best price.

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Run up to 300 watts RF power output.

SWR and dual range wattmeter (300 & 30 watts full scale, forward/reflected power). Sensitive meter measures SWR to 5 watts.

Flexible antenna switch selects 2 coax lines, direct or through tuner, random wire/balanced line, or tuner bypass for dummy load.

12 position efficient airwound inductor for lower losses, more watts out.

Built-in 4:1 balun for balanced lines. 1000V capacitor spacing.

Works with all solid state or tube rigs.

Easy to use, anywhere. Measures 8x2x6", has SO-239 connectors, 5-way binding posts, finished in eggshell white with walnut-grained sides.

4 Other 300W Models: MFJ-940B, $79.95 (+ $4), like 941C less balun. **MFJ-945, $79.95** (+ $4), like 941C less antenna switch. **MFJ-944, $79.95** (+ $4), like 945, less SWR/Wattmeter, **MFJ-943, $69.95** (+ $4), like 944, less antenna switch. Optional mobile bracket for 941C, 940B, 945, 944, $3.00.

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D-15	15	22	26.95	22.95
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SD-80	80,75	90	35.95	31.95
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Build the Revolutionary Parastat

After some rule-bending and wire-straightening, N6LM discovered the parastat antenna. It has gain when you want and a null when you don't.

This article is directed to the experimenter, particularly one who is partial to wire antennas. No construction information, other than minor basics, is included. The individual is permitted to fly on his own. A wall, a barn door, or Grandma's old curtain-stretchers may be used for a test stand.

To investigate the potential of an antenna for a restricted area, the old idea of the square radiator, i.e., a half-wave radiator equilateral, fed as a dipole, was resurrected. (See Fig. 1.) Years ago, this antenna was used as the basis for a spider-web array.

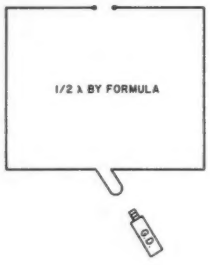


Fig. 1. Square half-wave radiator.

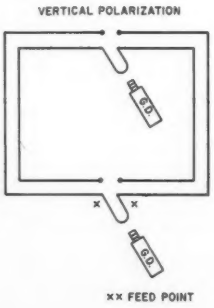


Fig. 2. Setup for vertical polarization.

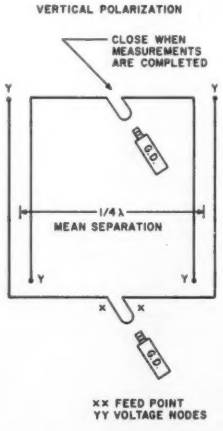


Fig. 3. Quarter-wave separation between legs.

A light X-frame was made up of 6-foot lengths of ¾-inch wooden stock, and a stand of scrap plywood

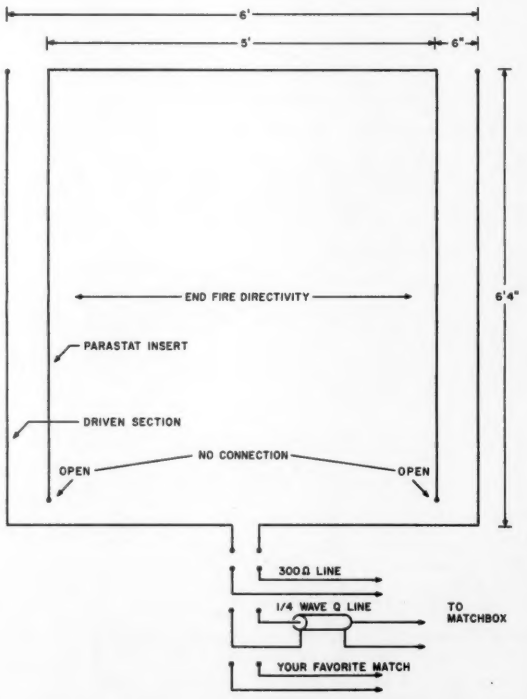


Fig. 4. Details of completed parastat antenna. Skeletal configuration guide—21.100 MHz; vertical polarization; zero broadside null. Radiation resistance is 38 Ohms, approximating that of a close-spaced radiator/director beam antenna.

was constructed to serve as our "test bed." One-inch wire finishing nails were tacked at two-inch intervals on the far ends of the X-frame to wrap, or support, our experimental antenna. No. 22 wire was used in our design. However, no. 18 bell wire or similar light copper stock would be preferable.

It is essential that a portable grid-dip meter and sensitive field-strength meter be available for pruning the antenna to desired frequency and for subsequent testing.

Getting back to our square half-wave radiator, it loaded well but its performance left much to be desired. As a receiving antenna, it was no match for a reference dipole. Rather than discard our efforts completely, we decided to play around with an unorthodox idea. Let's bend a few rules and see what happens when another element is placed inside our loop, opposite in phase, and driven electrostatically in parasitic mode (hence the name coined for this radiator: the "parastat"). See Fig. 2.

We had assumed this configuration would lower the resonant frequency, but we were not prepared for the extent of variation. At this point the grid-dip meter becomes indispensable. Start out by cutting both driven element and parasitic element to ½ wavelength of the chosen frequency, in our case 21.100 MHz. A single turn in the center of each element is set up for grid-dip-meter insertion.

Begin pruning the ends of each element for the desired frequency. Due to the proximity of the elements, an L/C relationship exists and "pulling" will occur as each is pruned to the frequency of the other. Continue pruning until the desired frequency is reached and the elements "slide" together in frequency.

Our antenna has now shrunk significantly, but it still retains some desirable features. It still loads satisfactorily; it approaches the receiving capability of the reference dipole. It also shows a marked increase in directivity and the broadside null is accentuated. Noise pick-up is greatly reduced; in fact, the antenna is now quieter than the reference dipole. On-the-air testing was favorable, signal reports were OK, and some DX was worked.

Considering further improvement, we decided to try ¼-wave separation of the two ¼-wave legs of the parastat, resulting in Fig. 3. Plan on a minimum of 20 feet of wire for each element (21.100 MHz) before pruning. Our test frame is revamped to accommodate the new structure.

A parastatic element is inserted and pruning is again undertaken to reach our selected frequency. A considerable reduction in physical dimension is again realized—to about 18% shorter than that produced by the classic formula for a ½-wave dipole. This system loaded well, showing a reasonable frequency response each side of the selected cut frequency. The system was fed with 300-Ohm ribbon line. A ¼-wave Q transformer between the antenna feedpoint and the 300-Ohm line was also tried. The ¼-wave Q line was made up of a short length of RG-58/U grid-dip cut to the operating frequency. A transmatch was used for tuning the system.

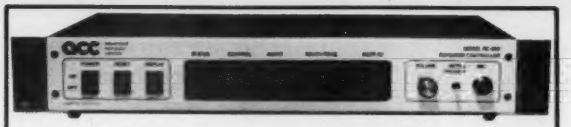
An interesting condition occurred while we were checking the directivity of the system. It was noted that the field-strength meter returned to a zero reading before the system was turned fully and completely broadside. Wondering about this somewhat strange behavior, the field-strength meter was picked up and moved to the system on a line broadside to the elements. Nothing happened to change the zero reading even when the instrument was placed directly in the center of the system. Very intriguing—a completely dead area, devoid of all radiation. Moving the field-strength meter about in this "black hole," it was found that the dead area was quite extensive, several feet in all directions from the center point of the system.

Also of interest, rather than two doughnuts or circles cheek to cheek as in a dipole radiation pattern, we found a definite elongated figure eight, indicating a reasonably sharp directional pattern.

It was a pleasant surprise to discover our latest effort surpassed the receiving capabilities of the reference dipole. It was nothing intense or remarkable, but there was a solid lift in signal strength, plus a significant decrease in noise. Signals formerly masked by background noise became readable. Local, stateside, and DX stations were worked—all continents. And the base of our test antenna stood only one foot above ground.

This configuration may be of interest to the apartment dweller or the amateur who must hide his activities in restrictive neighborhoods. It works out nicely from an interior room, having sufficient concentrated directivity to punch out a respectable signal. In areas where certain interfering signals are prevalent, its broadside black-hole null may be helpful in working around competition. It also suggests a superb HF direction-finding mode, in that the null will not spin out upon closure to a strong signal source.

For mechanical considerations and convenience, 21 MHz was used as a starting point; however, bolder amateurs may wish to project the idea to the lower frequency bands. ■



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This particular antenna was born out of need for a compact aerial that could be carried easily and set up quickly, primarily for indoor use but also for outdoor application, without need to suspend the system between two points. To achieve this end I decided to use a helical-whip configuration capable of working on all bands. The whip length purposely was limited to 2 meters (a little over 6 feet—or 79").

The helix was wound on a collapsible varnished bamboo fishing pole. This choice is the least expensive and most easily available. The pole is sold as a three-piece, 3-meter length (10-foot) unit, but to allow for easy indoor use when desired, it was cut to the aforementioned 2-meter length, consisting of two sections which fasten together.

For indoor use, a wooden board 61 cm by 61 cm by 2 cm (24" by 24" by 3/4") was fitted with a vertical plate of aluminum at the board's center. The plate was drilled to accommodate two 6-32 mounting screws to hold the antenna pole at its lower portion. The mounting holes were drilled 7.62 cms (3 inches) apart. This method of construction facilitates moving the aerial around in the house (and cellar). Ease in moving it also proves useful in portable camping type of operations. See Fig. 1.

Since the plug-in portions of the pole consist of copper-plated ferrule-like fasteners, these were taped over to allow the magnet wire to be wound over the metal portion and still have a measure of good insulation. A length of #16 enameled wire 42.6 meters (140 feet) long was wound on the pole as indicated in Fig. 2. Since my antenna was intended mostly for indoor use, the pole was not weatherproofed.

The antenna has been loaded on the 80-, 40-, 20-, 15-, and 10-meter bands by means of a random-wire antenna tuner. However, especially on the 80-meter band, a very good grounding system is important. An swr ratio of less than 1.1 to 1 has been achieved on all bands.

At my location the aerial grounding system has taken the form of a water-pipe ground plus a counterpoise wire about a quarter wave long. The counterpoise was cut primarily for the 80-meter band and made to extend around the radio-room floor. Care must be taken, as the end of the wire becomes hot with rf. Because of the importance of good grounding techniques, following are some observations on developing good grounds for indoor or portable operation.

A bad ground system results in difficulty in coupling the transmitter to the antenna and creates poor harmonic suppression resulting in TVI and RFI. This is due to (1) creation of an additional impedance level because of transmitter-chassis-system-to-ground impedance, (2) loss of rf power in poor grounds as a result of radiation in the transmitter's power cord, cabinet, and ground system itself, and (3) partial loss of effect of chassis bypassing resulting in harmonic currents radiating out rather than being bypassed to ground because the chassis is not then at ground potential.

The first and easiest approach to a good system is to connect the ground at a metal cold water pipe. This should preferably be done at the point where the pipe from the local water supply enters the dwelling. Another useful ground point is the metal pipe feeding the outdoor garden hose. (Be sure that the piping is of metal and not of plastic as it sometimes is.)

A counterpoise wire (or wires) is most useful (and many times an additional necessity) as an alternative to obtaining a good ground system. That is especially true in outdoor portable use or when setting up a rig

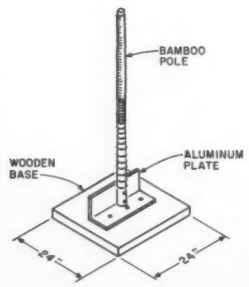

Fig. 1.

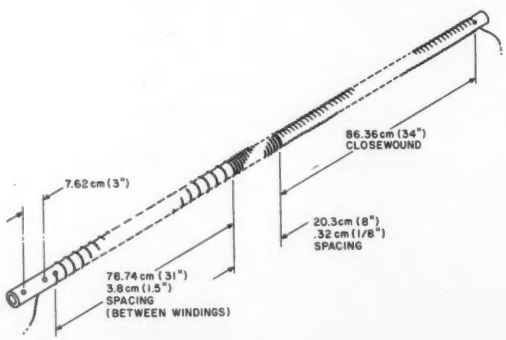

Fig. 2.

in a hotel room when traveling. The counterpoise consists of one or more wires connected to chassis ground. Each of the wires is cut to a length equal to .2 to .25 wavelength for each of various bands. The wires may have to be trimmed down a little at a time to get the most efficient ground as indicated by swr readings while the transmitter is loaded into the aerial. However, the surest way of checking out the total system is to use an antenna impedance bridge.

Either or both of the grounding methods just described plus use of an efficient random-wire antenna tuner will help load this helical antenna on all bands. With regard to the random-wire tuner, every radio amateur should have this accessory. It makes for more flexibility in antenna application, not limiting the operator to a particular type of antenna and operating band. It allows for use of almost any wire length for all amateur bands.

The antenna cost for basic materials was four dollars for the bamboo pole and two dollars and a half for surplus enameled magnet wire. The latter was easily obtained from a local transformer repair company.

As to antenna efficiency, with an output power of 20 Watts on 80- and 40-meter CW, with the aerial *in my cellar radio room*, consistent reports of 5-5-9 to 5-7-9 have been received at medium distances. This performance indicates that with placement of the antenna outdoors, it should perform as well or better than the common 30-foot base-loaded vertical. The six-foot helical antenna thus has the advantages of compactness, ease of installation, and physical durability when the aerial has been carefully weatherproofed. ■

AT LAST!

This service will be available nationally. Lab tested & time proven modifications professionally installed in your amateur Handy-Talkie 2M, 220, 440, MH2 transceiver by Henry Radios warranty technicians
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Outboard the dip switch! Have it neatly inlayed into the back cover of your Handy-Talkie making all 32 PL Tones Selectable at a moment's notice.

$25 Got your own PL? Send it to us with your Handy-Talkie unit and we do the professional installation for you.

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Send us your Handy-Talkie unit and a check or money order plus $3.50 for shipping and handling payable to **A&W PRODUCTIONS, INC.**

For **TEMPO** units the dip switch is inlayed into the Push-to-Talk bar. The **TEMPO S-15** will have the dip switch inlayed into the back cover.

$45 We will install a **NEW BATTERY BEATER** in your **TEMPO S-1, S-2, S-4, S-5 READY** to operate. Your New Battery Beater will use the same jack as the charger with no new holes and regulation circuits built into unit. Comes with Cigar Lighter Adapter with internal fuse.

CONTACT A&W PRODUCTIONS FOR SPECIAL MODIFICATIONS YOU MAY WANT TO HAVE DONE. WE SPECIALIZE IN THE TEMPO HANDY-TALKIES.

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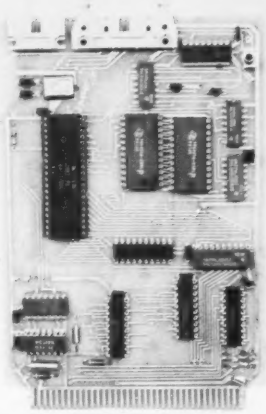

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With the Jarr Z8 Controller, 1000's of dedicated microprocessor control applications can be realized.

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AEA once again breaks new ground in the code communications field with the new model MBA-RC reader/code converter. The MBA-RC decodes Morse, Baudot or ASCII signals off the air and displays them on a large 32 character alphanumeric vacuum fluorscent display. In addition, it will output Morse code for keying your transmitter. It will also generate RTTY (Baudot or ASCII AFSK two tone output. (170 or 850 Hz shifts.) Any of the acceptable input codes can be converted to any of the specified output codes (any speed to any speed). If you have any of the common Baudot RTTY terminals as an example, you can now send and receive Morse and ASCII with your keyboard and printer. You can even generate ASCII or BAUDOT RTTY using your Morse hand key or memory keyer.

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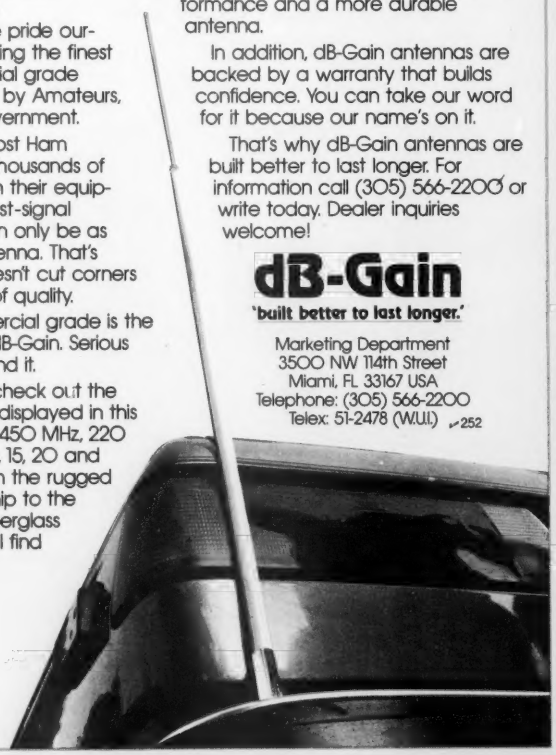

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For more information contact your local Kantronics Dealer or:
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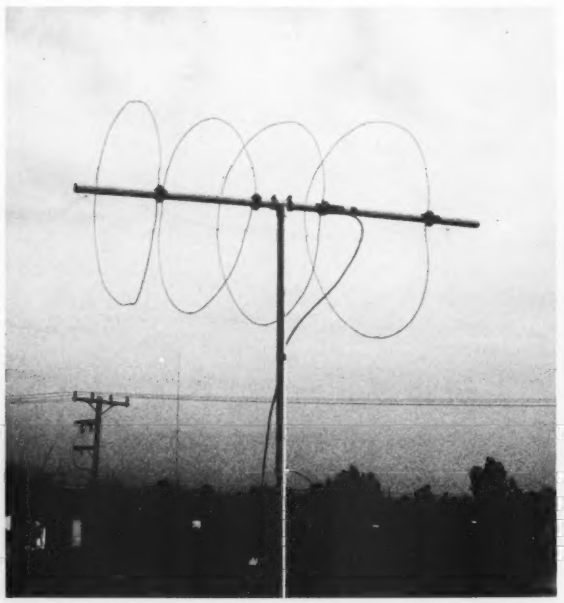
Nick Testa K6KTS
6420 Dominica Avenue
Cypress CA 90630

Build This Cornerless Quad for 2 Meters

Here's an antenna that you can cut corners on. All you lose is high cost.

A little over a year ago my oldest son, Nick, now KA6OXP, expressed an interest in becoming a ham. After dusting off a lot of vacuum tubes, it became clear that some new equipment was in order. Among the things purchased was a pair of two-meter hand-held transceivers.

Back on two meters after many years, I wondered whether I could work some DX and contact my old friend Tom WA6FIO. Tom lives some 50 miles away across Los Angeles. Our first contact was via repeater but left a lot to be desired in a rag-chew, with timers, QRM, and breaks to contend with. After spending a modest fortune to re-equip our ham shack, the prospect was dim for obtaining a linear or even a commercial high-gain 2-meter antenna. Enter LC4ELQ!



The LC4ELQ.

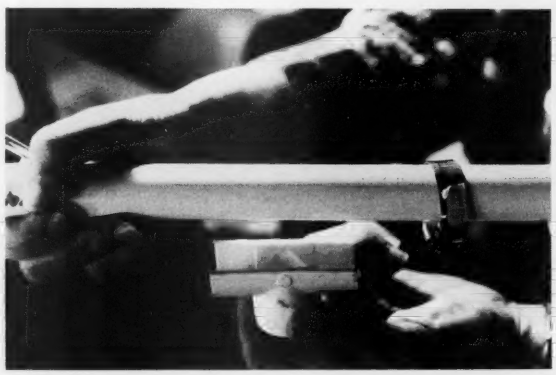
It is the answer to the question of how to boost your signal and reception on 2 meters at the lowest cost. If you have a low-power hand-held and want to use simplex across substantial local distances, as I did, or an SSB transceiver and are looking for the real DX, then LC4ELQ is for you.

It stands for Low Cost 4-Element Loop Quad. The antenna design is based on the 4-element quad but with some important changes to cut costs and simplify construction. A well-stocked junk box may contain all the necessary parts. Even if you have to buy all the parts new, except for an entire case of wire (which you will need only a small portion of), the expense will be under $10.00.

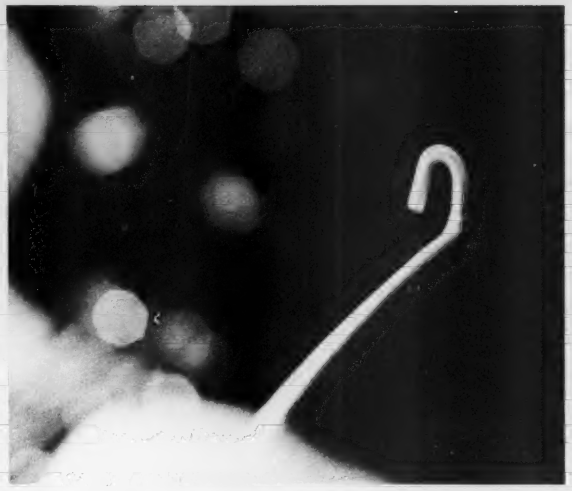
Construction

My trip to to the junk box yielded some 3/4-inch schedule 40 PVC pipe left over from a sprinkler system installation and a quantity of #8 aluminum ground wire (Radio Shack #15-036) left over from grounding my low-band rig.

Since I was interested in the design which would have the best chance of being self-supporting, I decided to make the elements loops instead of squares. This has the added advantage of allowing adjustment



The cut T being positioned on boom. The hose clamp is one of two which will be used to secure the T to the boom.



Forming the bolt hook and the 90° bend.

The end of each element should look like this. Length measures in the table are from the 90° bend to the one at the opposite end. The hook is not included in the dimension.

of the element size without the constant adjustment of corners. This in fact proved very handy at the tune-up stage. Due to the stiffness of the #8 wire, adjusting corners would have made the antenna look like it had been salvaged after being hit by a truck.

Four pieces of the wire were cut to length for a driven element, a reflector, and two directors. The lengths were determined as in a 2-meter quad design such as is found in the *ARRL Antenna Book*, plus 1 inch to allow for forming hooks at the attach points, less the length of the bolts through the boom for the reflector and director elements. In those three elements the 1/4-inch by 2-inch bolts serve as 1 inch of the resonant length. Each element was then formed into a hoop with the ends bent at 90 degrees and then bent to fit around the bolt and screw heads.

The next step was to prepare the boom and mast. I cut the 10-foot piece of PVC into a 4-foot and a 6-foot length. I also cut the top bar of a PVC T joint in half lengthwise. The stem portion of the T was glued to the end of the 6-foot piece of tubing to form the mast. I mounted the 4-foot length for the boom in the U-shaped cradle formed by the remaining top of the T using a pair of 1-1/2-inch-diameter hose clamps. The hose clamps can be loosened to allow for rotation of the boom for vertical or horizontal polarization.

Three 1/4-inch holes were drilled through the boom, one for the reflector and one for each of the directors. A 5/64-inch hole was drilled through the boom for the driven element. A 1/4-inch by 2-inch hex-head bolt was passed through each of the larger holes with a pair of flat washers on each side of the boom. The small hooks at the ends of the elements were slipped between the washers at each side and a nut used to fasten the assembly.

For the driven element, a #8 by 3/4-inch sheet-metal screw was inserted in each side of the boom. Each screw has a pair of 1/4-inch washers and a #8 washer, nearest the head, mounted on it. When the driven element is mounted, the shield and center conductor of 50-Ohm coax are connected, one to each screw. The screw acts as a terminal to connect the coax to the antenna. Solder or crimp #8 spade lugs to the end of the center conductor and shield to ensure good attachment to the antenna.

To tune the antenna, I adjusted the element lengths and spacings until the antenna provided a nearly perfect match to the transceiver across the entire 2-meter band. This gave me a prototype antenna with a few extra holes in the boom. The final lengths are shown in the table of element lengths. Be sure to note that the table gives the length between the 90-degree bends and not to the tip of the wire. I recommend that you form a 90-degree bend and a small bolt hook on the end of the wire and then measure to the next bend point. Make the bend, allowing enough wire to form the

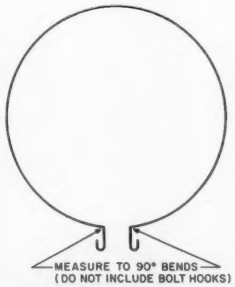


Fig. 1. Element setup.

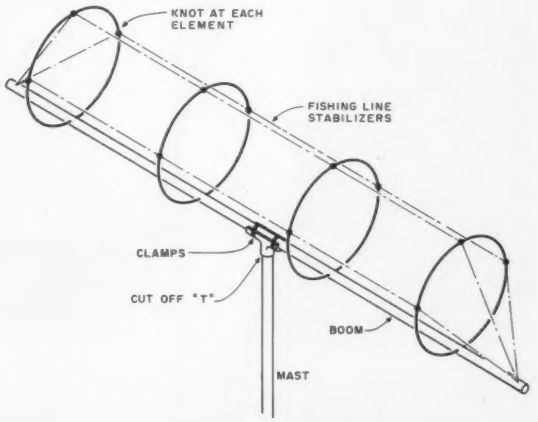
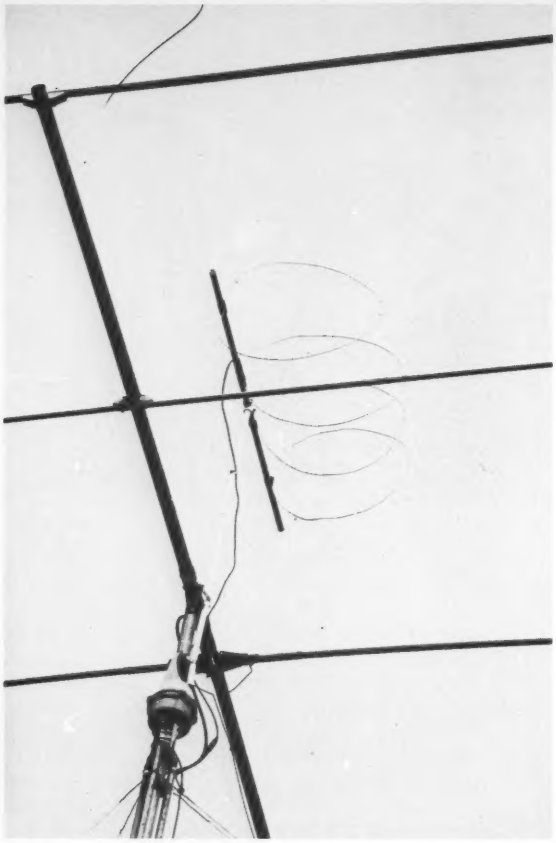


Fig. 2. Mounting pattern for elements.



The LC4ELQ antenna mounted above the tribander.

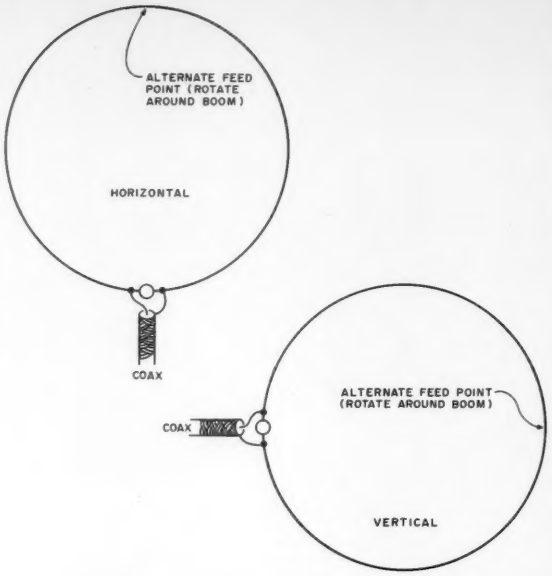
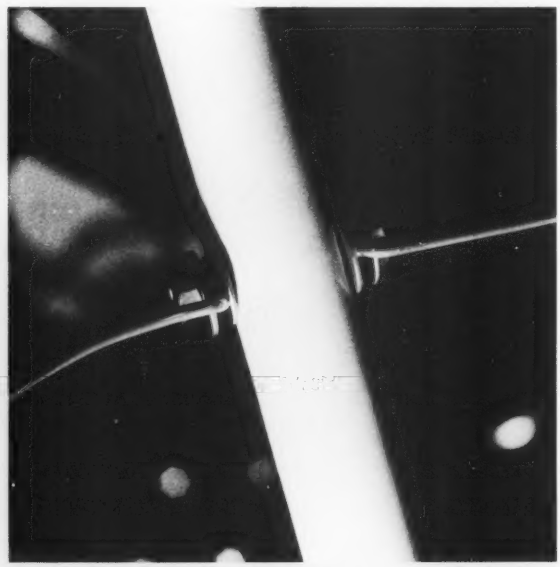


Fig. 3. Feedpoints for horizontal and vertical polarization.

hook around the bolt or screw, and then cut the entire piece off.

In making the swr measurements, I noticed that the relative motion between the elements was enough to change the swr. To prevent this I added three pieces of fishing line tied to each element and to the ends of the boom which extend beyond the elements. If, for example, the loop is fed at the 6 o'clock point looking at the antenna straight down the boom, a length of fishing line runs along the 9, 12, and 3 o'clock positions. A knot was tied at each element with a slight inward bend of the wire at the knot point to retard slippage. The ends of the three pieces of fishing line were tied together and then passed through spare holes at each end of the boom. George N6FFA, in testing copies of the antenna, found that squareness to



Element joined to boom. Note the pair of washers on both sides of the boom with the element between. 1½-inch bolts are shown in this picture; 2-inch bolts make installation of the nut easier.

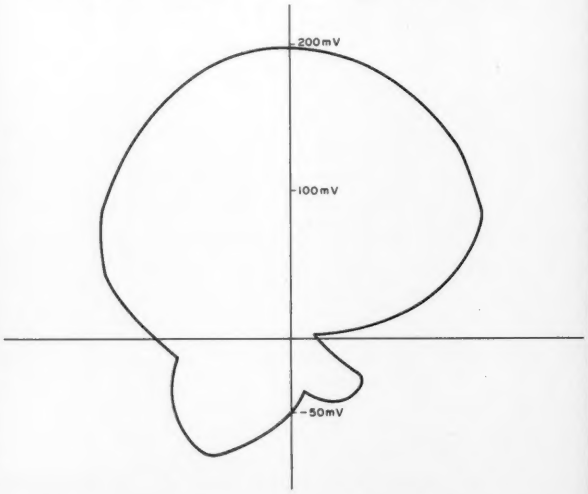


Fig. 4. Antenna pattern measured by N6FFA and KD6EH in millivolts of signal. The LC4ELQ was used as the transmitting antenna and rotated to produce the pattern.

Now you can chirp back!

AMTOR is here

Been wondering what those "chirp-chirp" signals were around 14075? They're AMTOR, AMateur Teleprinting Over Radio. European hams have been enjoying the benefits of error free RTTY for sometime. (It's a must for commercial Maritime traffic.) Now, U.S. Amateurs are on the threshold of a new era of RTTY.

Old problems of QRM, QRN, & QSB are gone! If a propagation path exists, AMTOR will get the message thru — with no "hits" — "newspaper" perfect copy!

Two modes are available; AMTOR mode A transmits a three character block specially coded so that the receiving station can recognize an error. The three character block is repeated until the receiving station confirms reception by replying with the proper control code signal. Flawless print is possible with this "hand-shake" style operation.

Mode B, "FEC" or Forward Error Correction, is actually a time diversity mode where text is repeated and intermixed in the transmission. The receiving station unscrambles it and prints the clear text. This "broadcast" mode allows more than two stations to communicate. It's more effective than conventional Baudot or ASCII, but not as reliable as AMTOR mode A.

The actual DATA transfer in either AMTOR mode is nominally equivalent to conventional RTTY at 50 baud, or 66 WPM.

A receive only "Listen" mode is also available for reception of mode A data by a station not directly involved in the "hand-shake" communication.

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MICROLOG

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Element Wire Lengths

Element	Length in Inches from 90° Bend to 90° Bend
Director #2	73-3/8
Director #1	74-3/8
Driven Element	79
Reflector	83-1/4

Element Center-to-Center Spacing

From	To	Distance in Inches
Boom End	Director #2	6
Director #2	Director #1	11-3/4
Director #1	Driven Element	8-5/8
Driven Element	Reflector	14-1/8
Reflector	Boom End	≈7

Measured Swr

Frequency in MHz	Final Adjustment Values (Swan)	Measured at 40 ft (Bird)
144.0	1.35	1.45
144.5	1.20	1.25
145.0	1.00	<1.14*
145.5	1.00	<1.10*
146.0	1.00	<1.10*
146.5	1.10	<1.10*
147.0	1.30	<1.10*
147.5	1.40	1.22
148.0	1.55	1.35

*Lowest reading on chart

S-Meter Measured Antenna Pattern

Degrees	dB over 9
0 (front)	30
15	28
45	28
75	28
135	10
165	20
195 -(back)	19
225	20
255	25
315	25
345	28

the boom and parallelism of the elements to each other reduced the rear lobe of the antenna. That means you should do the best job you can in these areas. For long-lasting protection of your connections, wrap each with electrical tape or, better yet, use a commercial silicone sealant to cover them.

Polarization

What would you like? Since I was interested in FM, I wanted a vertically-polarized antenna. I rotated the boom so that the feedpoint was on the side, 3 o'clock or 9 o'clock looking down the boom. This gave me vertical polarization. For horizontal polarization, place the feedpoint at the top or bottom of the loop, 6 o'clock or 12 o'clock. With vertical polarization, N6FFA did notice a reversal of the deep rear side notch in the pattern, depending upon which side the feedpoint was on.

Testing

Initial tests were made with the mast held by rubber bands to the desk drawers in my shack and the boom 6 feet off the floor. Readings were taken on a Swan VHF reflected-power meter. Also checked was the performance in vertical and horizontal polarization, and rough checks of directionality were made. The antenna was then clamped above my tribander at 40 feet. Swr tests were then repeated using a Bird model 43. Both sets of test results are shown in the tables.

With the help of Judi WB6SKE, I made the first pattern check. It indicated a front-to-back ratio of 20 dB. The data is also shown in the table. The distance between our QTHs is about 4 miles. N6FFA and Greg KD6EH made the radiation pattern graph shown from the millivolts of signal measured at Greg's location about 12 miles away from N6FFA.

Performance

Yes! I was able to work WA6FIO simplex at nearly full-quieting across the Los Angeles QRM with 1.5 Watts. This same power level has easily provided reliable nearly full-quieting communications via repeaters located in other cities nearly 200 miles away. My QTH is situated on flat land at about 50 feet above sea level so our own elevation is not a factor. Several other local hams have built and used the antenna on both FM and SSB with excellent results. I constantly receive the comment on the air, "You're that far away and just using 1.5 Watts; that's some antenna!" Try one for yourself and see what I mean.

Conclusion

The LC4ELQ is hard to beat for return on your dollar investment for each Watt of effective radiated power. The ease of assembly beats anything with spreaders. One fellow says he has built several and it now takes him much less time than the 45 minutes that he spent on the first.

If you're interested in minimizing your time in construction, drop me an SASE asking for information on a pre-cut and -drilled kit version. ■

Parts List

Quantity	Price	Description	Source
1	$2.19	10-ft. piece of ¾" schedule 40 PVC	Hardware Store
1	.39	¾" PVC T-shaped fitting	Hardware Store
2	1.18	1½" hose clamp	Hardware Store
3	.75	¼" × 2" bolt	Hardware Store
3	.15	¼" nut	Hardware Store
16	.80	¼" flat washer	Hardware Store
2	.10	#8 sheet-metal screws	Hardware Store
2	.10	#8 flat washers	Hardware Store
27 feet	.81	#8 aluminum ground wire	Radio Shack
35 feet	.14	#12 monofilament fishing line	Sporting Goods
	$6.61		

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Without doubt LR-1 is the repeater value leader! Compare its outstanding performance with any repeater -- then look at its price. LR-1 features include individual die-cast shielding of receiver and transmitter plus a separately shielded 6-stage receiver prefilter for peak performance in harsh RF environments • Front panel metering of all vital functions • CW identifier • Symmetric hard limiting for clean natural audio • Low power MOS control logic • Even the cabinet is included -- just plug in and go!

NEW

LINKING? The LR-1 is also available with control circuitry for Link Transceiver operation. Now link repeater sites with the flexible control capability you've always wanted.

HIGH POWER? Our PA-75 power amplifier is the champion! Ruggedly built to give years of dependable operation in continuous duty repeater service.

NEW

Mark 3C repeaters and controllers have no equal in performance. Both units feature auto patch, reverse autopatch, autodial, 13 Morse messages and a total of 39 functions. Both feature microprocessor control and both have been proven in the field from icy Alaska to tropical Brazil. A Mark 3C supercontroller can make any repeater a super performer. The Mark 3CR repeater is in a class by itself. It combines superbly designed RF circuitry in one handsome package. It is without doubt the world's most advanced repeater!

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FL-45 500 Hz CW filter	59.50	
EX-195 Marker unit	39.00	
EX-202 LDA interface; 730/2KL/AH-1	27.50	
EX-203 150 Hz CW audio filter	39.00	
EX-205 Transverter switching unit	29.00	
HM-10 Mobile scan microphone	39.50	

$50 FACTORY REBATE

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EX-241 Marker unit	20.00	
EX-242 FM unit	39.00	
EX-243 Electronic keyer unit	50.00	
FL-44 455 KHz SSB filter	159.00	129.95
FL-45 9 MHz 500 Hz CW filter	59.50	
FL-54 9 MHz 270 Hz CW filter	47.50	
FL-52 455 KHz 500 Hz CW filter	96.50	89.95
FL-53 455 KHz 250 Hz CW filter	96.50	89.95
MB-12 Mobile mount	19.50	
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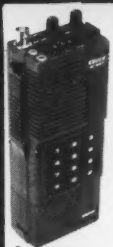

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The use of tuned feeders makes possible the construction of a single antenna that will work well on two or more bands and which will load up equally well on any frequency in each band, whether the frequency is phone or CW.[1] Tuned feeders will feed "oddball" antenna-wire lengths that would be impossible to feed with coaxial cable.[2] Tuned feeders also have other advantages that have been described in previous *73* articles.[1,2,3] Because of these things, radio amateurs who like to experiment can use tuned feeders to try out many different antenna ideas. The one disadvantage of tuned feeders (resonant lines) is the extra work of adjusting the antenna tuner. However, people who like to experiment usually do not mind this extra work.

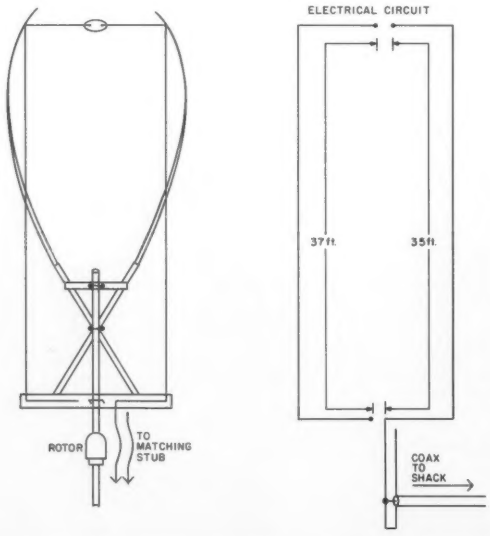


Fig. 1. "Chinese Inverted Ice Tongs" vertical beam antenna. Tuned feeders could have been used.

Vertical polarization is not commonly used with beam antennas even though it has worthwhile advantages for DX communication. The purpose of this article is to present some experiences and ideas which will encourage its readers to experiment with vertically-polarized beam antenna systems fed with tuned feeders.

It is axiomatic that at easily attained heights, vertical antennas radiate rf at lower angles to the horizon than do horizontal antennas.[1] This accounts for those cases in which vertical antennas have made DX contacts that horizontal beams have been unable to make.

For many years I worked DX using vertical antennas, but was unable to work DX using horizontal antennas. It was only natural for me to think in terms of vertical polarization when I decided to build a beam antenna. The first result of this thinking was what was called the "Chinese Inverted Ice Tongs Antenna," so named because it was made of two long bamboo fishpoles and had such a shape. See Fig. 1. This was a two-element vertical beam for 20 meters using an antenna wire and a reflector wire supported by a frame made of the bamboo fishpoles and some 1-by-2-inch lumber. The antenna was fed as a vertical J. This antenna worked DX quite well. (The bottom of the antenna was 40 feet up from

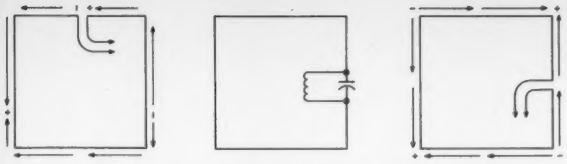


Fig. 2. 20-meter quad tuned to resonance on 15 meters (left) and 10 meters (right). Reflector with 15-meter trap in vertical wire behind the feedpoint is shown in center.

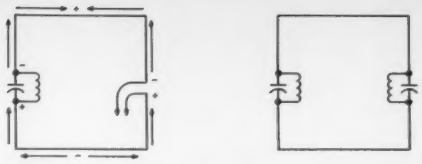


Fig. 3. Use of 10-meter traps to make a 20-meter quad fed with tuned feeders function as an "expanded quad" on 10 meters. (Reflector traps are tuned to a frequency just outside the low-frequency end of the band.) On the left is a 20-meter quad antenna tuned to 10 meters with a 10-meter trap opposite the feedpoint. On the right is a 20-meter quad reflector with 10-meter traps in the vertical wires.

the ground. "There is no substitute for height," as Harry, my best radio amateur friend and "consulting engineer," often remarked. When I told Harry about the DX QSOs, he laughed and replied, "Well, the laws of physics have not been repealed.")

The next vertically-polarized beam was a 2-element 20-meter quad fed in the center of one of its vertical wires. This antenna also worked very well. When I moved to another state, I put up the quad and fed it in the center of one of its vertical wires using tuned feeders for vertical polarization. The antenna worked even better than it did before, even though it was about 6 feet lower than it was in its former location.

One of the characteristics of a vertically-polarized beam is that the rf is radiated in a wide-angle beam. This has been very helpful in carrying on three-way schedules from St. Louis with stations as far apart as Scottsdale, Arizona, and Lake Stevens, Washington. I point the quad at whichever station is weaker and both stations can copy my signals. The great width of the beam is especially helpful when I do not know the exact direction in which the beam should be pointed. (Some people might consider this wide beam to be a disadvantage, but I have not found it to be so.)

The 20-meter vertically-polarized quad is excellent for working DX. When the band is usable, the DX stations that are called usually answer. The tuned feeders put the rf into the antenna with great effectiveness. If there had been any doubts about this, they would have disappeared when I worked YU5FAM with less than 1.25 Watts rf output from a Heathkit HW-8 QRP transceiver.

As an experiment, the 20-meter quad was tuned up on 15 meters. It worked very well on this band and many DX stations were worked. A mental analysis of the standing waves on the antenna shows that the two vertical wires of the antenna are excited in phase (broadside radiation). The rf standing waves on the horizontal wires cancel each other. It is hard to know what is happening in the reflector. It may be acting only as a shield to make the beam unidirectional. A 15-meter trap in the reflector on the same side as the feedline would probably make the reflector into a real reflector on 15 meters.

A mental analysis of the standing waves on the 20-meter quad loop, if tuned to 10 meters, showed that the vertical wires would be 180 degrees out of phase and would provide endfire gain and directivity in the plane of the two wires. See Fig. 2. This would be at right angles to the way the quad was pointed as shown on the rotor control box. The vertical endfire beam would be bidirectional. (The horizontal wires would be 180 degrees out of phase also, but the up and down endfire effect would not be useful for terrestrial communication.) The quad was tuned up on 10 meters and the plane of the wires was aimed towards Europe (45 degrees plus 90 degrees, or 135 degrees clockwise from north on the rotor box dial). The first European CQ answered did not result in a QSO, so I called "CQ DX." G3ZRH replied,

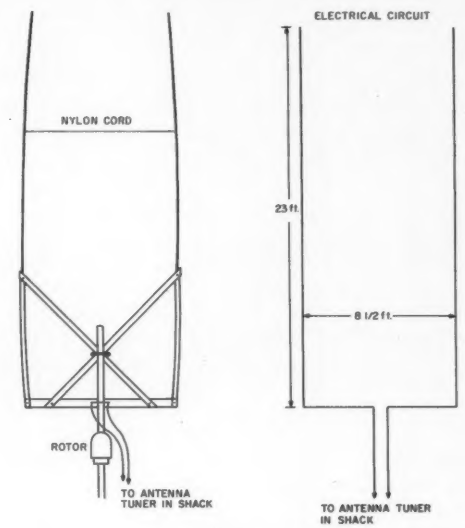


Fig. 4. The "XU" bidirectional beam antenna.

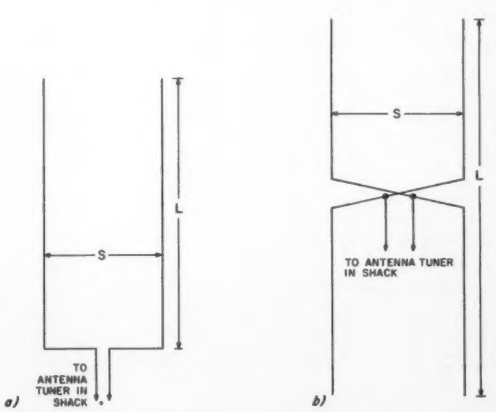


Fig. 5. Electrical circuits of fixed vertical endfire beam antennas. (a) Bottom endfed W8JK endfire vertical beam antenna. (b) Centerfed W8JK endfire vertical beam antenna.

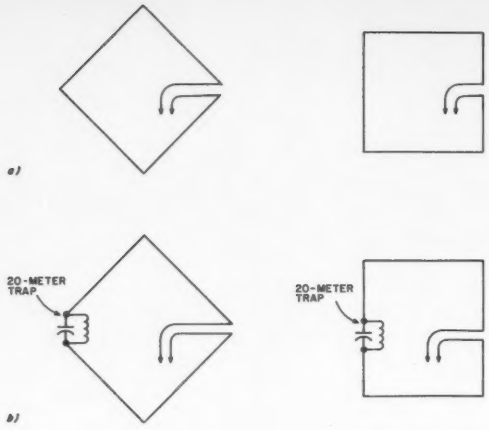
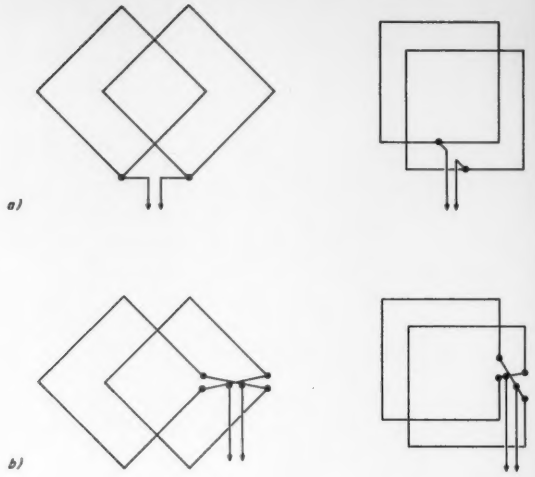


Fig. 6. (a) Vertically-polarized 40-meter quad loops (34 feet each side with tuned feeders going into shack). (b) Vertically-polarized 40-meter quad loops with 20-meter traps for "bisquare" functioning on 20 meters.



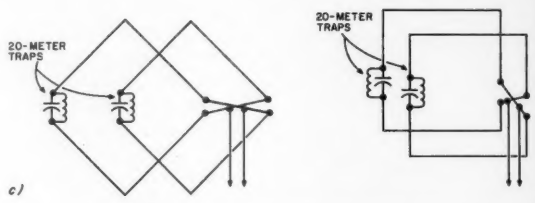


Fig. 7. Two-element vertically-polarized bidirectional 40-meter quads—bottomfed (a) and sidefed (b). (c) Sidefed vertically-polarized two-element bidirectional 40-meter quads with 20-meter traps for "bisquare" functioning on 20 meters. (Each side of these antennas is 34 feet long. Distance between loops is 17 feet.)

giving a 549 report. DJ4DA, DJ4IR, and OK1KPA were worked by calling "QRZ?" at the end of contacts. Another contact was made by answering the CQ of EA4VQ. "QRZ?" after that QSO brought back SM7DWY. The worst signal report from these six consecutive QSOs was the first 549. At least the 20-meter quad could be used on 10 meters.

According to the graph of Fig. 4-20 on page 140 of the ARRL *Antenna Book* (13th Ed.), the gain of half-wave elements fed 180 degrees out of phase and spaced ½ wavelength is slightly more than 2 decibels. The vertical polarization and the one-wavelength height above ground probably account for the good results on ten meters described above. However, a gain in the normal direction of 7 or 8 dB could be obtained on ten meters with a 20-meter tuned-feeder-fed quad by using ten-meter traps as "insulators" in both the antenna and reflector. See Fig. 3. This would make the antenna an "expanded quad" on ten meters.[3]

Endfire beam antennas can be used on two or more bands when they are fed with tuned feeders. The end-fed W8JK antenna can be mounted vertically and fed on the bottom with tuned feeders. The spacing between the elements should be ⅛ wavelength for the lowest frequency to be used. The length of the vertical elements should be no longer than ¾ wavelength for the highest frequency to be used. Twenty-three-foot vertical elements spaced 8½ feet apart make a good setup for an endfire bidirectional beam for 20, 15, and 10 meters. Vertical elements 26 feet long would be better electrically, but would be more difficult to build. Twenty-three feet can be obtained by telescoping two 12-foot lengths of aluminum alloy tubing with an overlap of one foot. (This tubing is sold in 12-foot lengths; outside-diameter sizes differ by ⅛ inch and .035-inch-thick walls permit the tubes to telescope into each other.) Twenty-three-foot bamboo fishing poles make very good vertical antenna supports. My endfire beam used two 23-foot bamboo poles, each with 23 feet of number 12 insulated house-wiring wire taped to it with electrician's tape. The bamboo poles were held in place by an X-shaped frame constructed with 1″×2″ lumber. Because of its appearance and the bamboo poles, it was named the "Chinese XU Antenna." See Fig. 4.

In constructing the XU, the bamboo poles were pointed a bit outward. About six feet down from the tops of the poles, a nylon cord was fastened to pull the poles together. This tension preserved the 8½-foot spacing between the wires.

Since 23 feet is only ⅓ wavelength on 20 meters, the beam was somewhat less effective on that band than it was on 15 and 10 meters. However, it did work fairly well on 20 meters. In a 20-meter QSO with a station in Leningrad (USSR), the signal report given was 579. When the transmitter was switched to the 20-meter quad, the signal report was changed to 599. That the center of the quad was somewhat higher than that of the XU may have been a factor in the better report. Until a heavy storm took it down, the XU performed very well on 10 and 15 meters. The rotor used was an old CD-AR-22. If one cannot afford a quad or yagi (mounted up 70 feet), an XU bidirectional beam would be well worth considering. Besides being less expensive than a quad, an XU is easier to put up.

Two fixed vertical antennas can be fed 180 degrees out of phase to form a bidirectional beam. For a bidirectional beam to be used on 80, 40, and 20 meters, the spacing (S) between the ver-

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tical elements should be 35 feet (¼ wavelength for 80 meters). For a bottom end-fed antenna, the height of each element (L) should be no more than 50 feet (¾ wavelength for 20 meters). See Fig. 5(a). For a centerfed vertical W8JK beam, the total height of each element could be as long as 100 feet if one could find mechanical means of supporting such heights. See Fig. 5(b).

Although the beamwidth of such a beam would be very broad, the tuning of the antenna tuner would be sharp (especially on 80 meters) and the tuner would have to be carefully touched up when changing frequencies within a frequency band (because of the relatively high Q of the antenna system).

A full-wavelength vertically-polarized quad loop would be good for working 40-meter DX. For vertical polarization, the quad loop should be fed on one end for the diamond-shaped loop, or on one of the vertical sides of a square loop. See Fig. 6(a). This loop would have a gain of 1.4 dB as compared with a dipole and would have low angle radiation.

By putting a 20-meter trap in the loop opposite the tuned feedline, the antenna would become a "bisquare array" on 20 meters with a gain of at least 4 dB as compared with a dipole.[3] See Fig. 6(b).

Using tuned feeders, a fixed quad with two loops can be made bidirectional See Fig. 7. Two 40-meter loops 34 feet on a side with 34-foot spacing between the loops, as shown in Fig. 7(a), would provide a gain of 3.7 dB on 40 meters as compared with a dipole. This antenna system would also work on 80 meters and would be vertically polarized on both 40 and 80 meters. If 80-meter operation were not desired, the spacing between loops could be reduced to 17 feet and provide a gain of 4.3 dB as compared with a dipole.

Feeding the loops on the side with the conventional W8JK center-feed method would also provide vertical polarization. See Fig. 7(b). A 40-meter bidirectional quad could be made to function as a bidirectional expanded quad on 20 meters by adding a 20-meter trap in the center of each side, opposite where the feedline is connected. On 20 meters, the gain would be at least 7 dB as compared with a dipole. See Fig. 7(c).

If you have never tried a vertically-polarized beam or if you cannot afford a commercially-made quad or yagi "way up in the air," try one of the vertically-polarized beam antenna systems described in this article. With a good, carefully adjusted antenna tuner, each of these antenna systems will load up equally well on both phone and CW frequencies in each band, with a very low swr on the coax between the transmitter and the antenna tuner (usually 1 to 1). This will make the transmitter happy, and the resulting DX QSOs will make you happy. For good DXing, try a vertically-polarized beam antenna. ■

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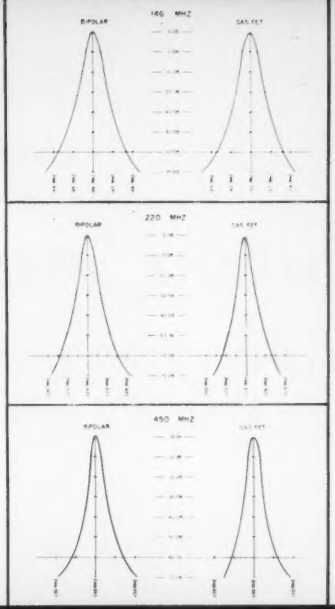

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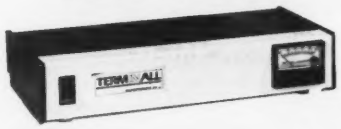

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Condo Secret Agent

The word at many condominiums is "no antennas allowed." Here's how one ham survived.

Have you ever seen a notice like this: "*. . . no exterior antennas and aerials shall be erected except as provided under uniform regulations promulgated by the [condominium] Association*"?

This standard phrase or similar wording used by most Florida condominiums dismays amateur operators contemplating purchase of a condominium housing unit. When one buys into the condo, one agrees to abide by the Declaration and the Association bylaws. There is a considerable body of law under Chapter 718 in the Florida Statutes called "The Condominium Act." The law specifies a Declaration of Condominium as a kind of Magna Carta designed to protect both the developers and owners in organizing and operating a condominium community. The Declaration is a legal instrument recorded in the public records of the county where the condo is situated.

The Association is a nonprofit corporation made up of the unit owners of the condo. Members elect a Board of Administration which runs the affairs of the condominium. It has legal recourse in the event of Declaration or Association bylaw violations. Most condominiums (particularly those with lawyers on the board) are hard-nosed about sticking to the letter of the Declaration. So, how does the ham cope with these restrictions?

The condo purchaser can treat as his own private home the space contained *within the interior walls of his unit*. He can install an inside antenna, if he wishes, subject to other restrictions prohibiting nuisances (TVI, RFI, etc.). The exterior walls, roof, parking lots, trees, lawns, recreational areas, etc., are considered Common Elements to be used and enjoyed by all owners collectively.

Then there are Limited Common Elements *outside the exterior walls*, such as patios, balconies, and garage stalls which may be used exclusively by the owner whose unit adjoins or is attached or assigned to such Elements. This *might* be an out for hams who mount mobile antennas on balcony railings—maybe.

Many condo hams surreptitiously use the "invisible" antenna, an end-fed random length of fine wire strung across a lawn or roof. Some load up down-spouts or metal gravel-stops around the roof—TVI generators if the joints are not welded or effectively bonded. I have heard of ingenious hams who magnanimously donate flagpoles to their condominiums which actually are PVC masts concealing trap verticals inside, with Old Glory proudly waving in the rf field. Other amateurs temporarily run coax out windows and feed mobile antennas on their nearby autos—apparently legal, but creating safety hazards if the cables can be tripped over.

And some hams brazenly install antennas on their condo buildings without permission, hoping they can get away with it. Perhaps some do. Others, such as the writer, attempt to get permission from the Association.

Shortly after moving into my condo, I asked the board president for permission to mount a couple of simple antennas. (Forget about beams and phased arrays—don't press your luck!) I told him I wanted an inconspicuous dipole raised within a line of palm trees along the beach dune, about 100 feet from the building, and a small vertical rod for two meters on the roof. The president cited the Declaration restriction, but said he would allow me to bring up my request at the next annual membership meeting. So, my plea was included under New Business on the agenda.

At the meeting, my

presentation emphasized the public service aspects of amateur radio, such as providing emergency communications during power or telephone outages following storms or hurricanes. That perks up interest among Florida East Coast residents. I also assured the membership there would be no towering structures or rotatable elements (unsightly in the eyes of non-hams). There would be no loose cables or tangles of wires, I promised. And I also could promise no TVI since our building was served by cable TV. (So far, no problems have been reported.)

After a few questions, all of them friendly, the membership voted to grant my request, and the action was so recorded in the official minutes of the meeting. A legal-eagle type might question whether the Association could waive a provision in the Declaration without properly amending it. Whatever, I at least obtained from the Association an agreement not to *enforce* the pertinent provision. And I was in business.

It seemed prudent, even with permission, to minimize use of the Common Elements, using Limited Common Elements (designated for my personal use) and my own private property where possible. The exception was the dipole which had to be mounted among Common Element trees and the feedline under the Common Element lawn. RG-8/U was buried in a lawn slit which quickly grew over and is undetectable. The coax emerges beneath a palm tree and is neatly dressed up the trunk where the antenna center feedpoint is secured. The dipole is a 75-40 meter trap affair which also loads up fairly well on 20 meters. The two-meter Ringo Ranger was mounted on the roof air-conditioning unit which is my private property. Its maintenance and ultimate replacement are at my expense, not the Association's.

Then came the sticky part—how to get the feedlines out of the apartment without drilling holes through the exterior Common Element walls. Access to the dipole resolved itself. I discovered a one-inch plastic pipe had been installed under the apartment floor to drain the air-conditioner condenser in the utility room. The pipe terminated at ground level outside. Obviously, this was a Limited Common Element for my use, so it became a conduit for a length of RG-58/U, connecting outside to the heavier coax to the dipole.

Next, how to get the coax to the Ringo on the roof? Certainly, cable snaked up the exterior wall and across the roof would be a no-no. What about the space between the interior walls, as in concrete block? This seems to be a gray area, although it probably is a Common Element. No matter. Through that space runs thin-wall metal conduit from the utility room to the roof. It contains the ac wiring for my roof air-conditioning unit. Again, this seems to be a Limited Common Element for my use, so with an electrician's fish-tape, I pulled up another length of RG-58/U to the roof circuit-breaker box (my private property) adjacent to the air-conditioner where the vertical was installed. (Eventually, I replaced the RG-58/U with Radio Shack's new small-diameter RG-8/M.)

Later, I replaced the Ringo with a Cushcraft ATV-3 20-15-10-meter trap vertical. (Well, 14 feet is still a "small vertical rod," isn't it?) I could work the local two-meter repeaters with an inside antenna. Radials for the new vertical were out, of course, since this would require a multi-wire radial system extending over and secured to the Common Element roof. Ground-strapping the antenna base with heavy braid to the metal mass of the air-conditioner housing seems to work about as well as radials, with only small excursions from the manufacturer's impedance and element-length specs.

Incidentally, an unexpected bonus came with the three-band vertical: It turned out to be four-band! It seemed to load up, get out, and receive as well on two meters as the Ringo. A check with the swr meter at the transmitter indicated almost 1:1 in the 146-147 MHz range. I *can't* explain it!

The apartment dweller often has problems running coax from one room to another. My cables enter the apartment in the utility room which is separated from the ham shack by a bathroom. At first, I could find no easy and inconspicuous way to route the cables across the Porcelain Palace. Then I noted the one obvious fixture which spanned the walls—the shower curtain rod! A little masonry drill work on *my* walls, and the shower rod became a conduit for the coax.

I have been operating from my condo for three years, and so far there has been no complaint from any of the owners. Although I have a 1-kW linear, I use it sparingly. The exciter output level is adequate in most situations. But even with the linear, I have had no indications of interference.

Maintaining a low profile is one way to retain the operating privilege after obtaining it. Hence, the semi-concealment of my QTH. ■

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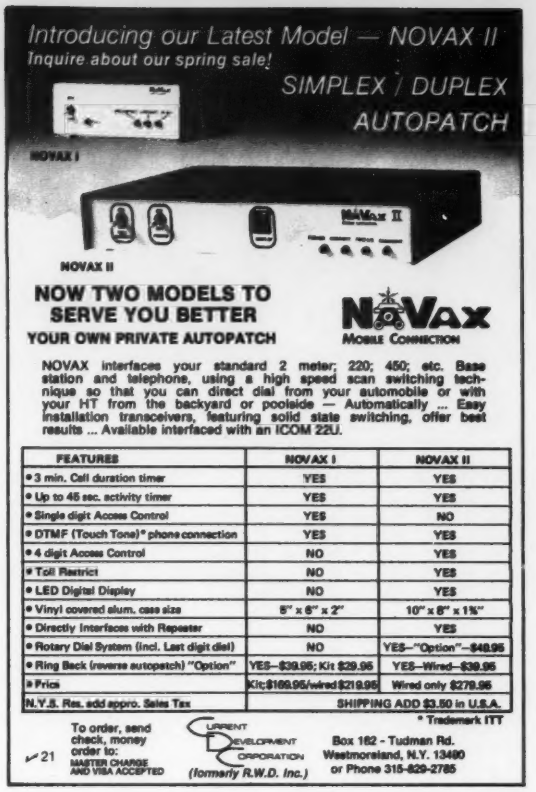
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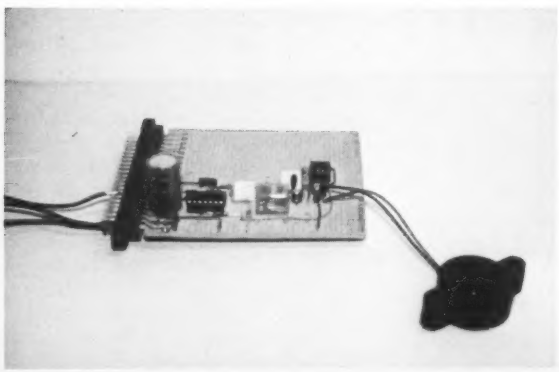
Having recently acquired an Icom 720A and played with it for several weeks, I decided to investigate some interface controls utilizing the information interface provided on the back panel (24-pin molex® plug). According to the operator's manual, pin 13 provides an output voltage which varies with respect to the band selected. The voltage, as indicated by the manual and my test, changes approximately 1 volt per band—following this pattern: 1.8 MHz ≈7.0 V, 3.5 MHz ≈ 6.0 V, 7.0 MHz ≈ 5 V, 14.0 MHz ≈ 4.0 V, 18-21 MHz ≈ 3.0 V, 24-28 MHz ≈ 2.0 V, 10 MHz ≈ 1.0 V.

Now, being basically lazy (and forgetting to change the antenna from the beam to the inverted vee), I decided to design an interface which would do it for me. I needed a circuit which would define and capture a voltage threshold and switch my antenna (via a coaxial relay) when my rig makes the transition from a low band to a high band.

Since 4.5 volts and lower represents the high bands and 5.0 volts and higher represents the low bands, what I needed was a switch that was off (0 V) for an input voltage greater than 4.8 volts and on (Vcc) when the input voltage was less than 4.8 volts. The 4.8 volts is the threshold voltage I selected. My source voltage (Vcc) is 13.8 volts. (By the way, the 720A provides 13.8 volts out on pin 2 with pin 8 being ground.)

I needed an op amp which was easy to use with a single-ended power supply and had a fairly decent slew rate. It was a job for an LM3900, set up as an inverting comparator. Next I needed an NPN transistor capable of switching relay-coil current; I chose the good ol' 2N2222. Since my relay has a coil-voltage rating of 5 volts and my source voltage is 13.8 V, I needed to drop about 8 volts. The transistor will drop about 1 to 1½ volts when saturated (on). Use an LED to drop another volt or so. The LED also lets you know when the comparator has switched states and that the transistor is on. A 100-Ohm resistor completes this series circuit.

The schematic in Fig. 2 shows a few things I haven't talked about, such as a diode across the relay coil, a couple of capacitors, and a spe-



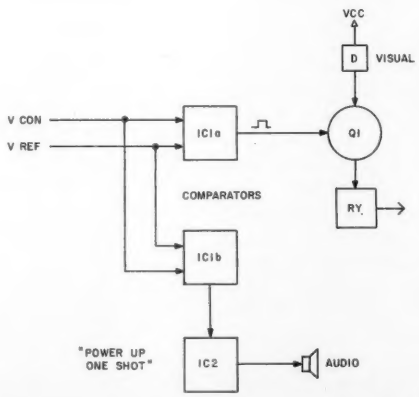


Fig. 1.

cial audio circuit (more on this later). Let's get to the heavy stuff—making the comparator switch states. The output of the comparator will be in one of two states: 0 volts and Vcc (approximately). If you prefer to think in logic, 0=0 volts and 1=Vcc. The output of my Icom 720A (pin 8) was 5 volts on 7.0 MHz and 4 volts on 14.0 MHz. A note here—If you refer to the pattern of changes given in the first paragraph of this article, you will see that it is arranged in order of the output voltage, not the amateur bands. Therefore, when you change from 14 to 7.0 MHz, you go through 10 MHz. In terms of voltage you will go from 4.0 volts (14 MHz) through 0 volts (10 MHz) back to 5.0 volts (7.0 MHz) and the relay will drop in and out. This is the reason I have a 470-uF capacitor (C1) on the input of V control to help hold this voltage up.

I selected 4.8 volts as my threshold voltage (Vref). When the input goes above 4.8 volts, the output goes low (0 volts), and when the input goes below 4.8 volts, the output goes to Vcc. The output I'm referring to is that of the comparator—pin 4, with pin 2 being Vref and pin 3 being Vin. To get Vref, a simple voltage divider will do. Referring to Fig. 2, we see that R2 is 10k Ohms. What we need to do now is to determine the value of R4. Using the voltage-divider rule:

$$Vref = \frac{R4\ (Vcc)}{R2 + R4}$$

$$4.8\ V = \frac{R4\ (13.8\ V)}{10k + R4}$$

$$48k + 4.8(R4) = 13.8(R4)$$

$$48k = 9(R4)$$

$$R4 = \frac{48k}{9}$$

$$R4 = 5.33k\ Ohms$$

If someone uses other than 13.8 V as Vcc, then Vref will change. To eliminate this problem, use a 25k-Ohm trimpot.

Special Audio Circuit

The 720A is a very good rig for the sightless amateur by virtue of the fact that it establishes certain operating parameters and conditions when powered up. With this being the case, why not make the modifications useful for the sightless amateur? Since the LM3900 is a quad-op-amp package and I'm only using one of the four op amps, it would be a simple task to generate another control line whose output voltage would follow that of the first op amp. I call this op amp 1B. When I say simple, I mean it—just parallel the inputs—pin 12 to pin 2 and pin 11 to pin 3. By doing this, both op amps have the same input resistors (R1 and R2) and both use the same Vcon and Vref voltages. The output voltages—pins 4 and 10—are identical, yet independent of each other.

Op amp 1B is used to turn on a 555 which is wired as as "power up one-shot." When this circuit is activated, a high (Vcc) appears on pin 10 and a short beep will be heard from the solid-state piezoelectric speaker. The time duration of the beep is set by R8 and C2. This beep will occur at the same time the LED comes on, indicating that the antennas have been switched.

The project can be built in one evening with Radio Shack supplying all the parts except the coaxial relay for approximately $20.00. Layout is not critical and point-to-point wiring can be used. (I used a prototyping board to test the circuit and then transferred to an edge-connector board.)■

References

Design Op-Amp Circuits with Experiments, by Howard M. Berlin, Published by Howard W. Sams and Co., Inc., Indianapolis IN 46268.

IC Timer Cookbook, by Walter G. Jung, published by Howard W. Sams and Co., Inc., Indianapolis IN 46268.

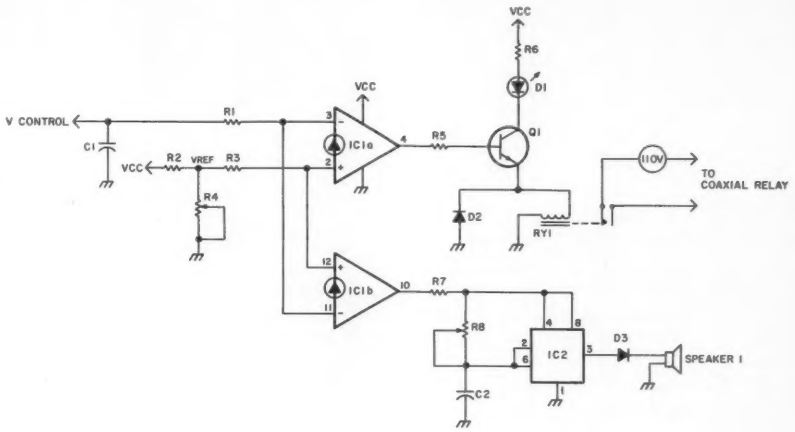


Fig. 2.

Parts List

Item #	Radio Shack Part Number	Qty.	Name	Description	Ref. Desig.
1	276-1713	1	IC	LM3900 - Norton quad op amp	IC1
2	276-1723	1	IC	NE555	IC2
3	276-041	1	diode	LED	D1
4	276-1101	2	diode	1N4001	D2, D3
5	276-2014	1	transistor	2N2222	Q1
6	275-216	1	relay	5 V dc coil, 1 A @ 125 V ac, SPST	RY1
7	273-060	1	speaker	Solid state piezo type	SPK1
8	272-1030	1	capacitor	470 uF @ 35 WV dc, PC mount	C1
9	276-1421	1	capacitor	3.3 uF - low leakage	C2
10	271-1356	2	resistor	10 meg, ¼ Watt	R1, R3
11	271-1335	1	resistor	10k Ω, ¼ Watt	R2
12	271-1330	2	resistor	4.7k Ω, ¼ Watt	R5, R7
13	271-012	1	resistor	100 Ω, ½ Watt	R6
14	271-218	1	trimpot	10k Ω, ⅛ Watt	R4
15	271-229	1	trimpot	1.0 meg	R8
16	276-1551	1	edge connector	44 pin .156 × .200"	
17	276-154	1	PC board	4½" × 4" 44 pin	

The New Communications: VHF Mailboxes

Join the growing wave of hams using digital techniques to get their message across. AF2M describes the (log) ins and outs of mailbox systems.

Robert Swirsky AF2M
412 Arbuckle Avenue
Cedarhurst NY 11516

Radioteletype is a mode that is getting much attention these days. With so many hams using microcomputers and the large number of people with Teletype™ model 15s, 19s, and 28s, the popular RTTY frequencies are crowded. One of the reasons RTTY is so popular is that the mode is especially suited to automated and computerized embellishments. It is possible to leave the TTY machine set up, leave the shack, and return to see whatever activity was on frequency. To facilitate this, the autostart system was developed. Autostart senses a mark signal on frequency and readies the Teletype machine for copy. This way, the TTY is not on all the time and doesn't print out garbage in the absence of a signal.

While autostart is all well and fine, it does have some serious limitations. One of them is that you receive a copy of everything sent on frequency. If you are just looking for one specific message, you might have to do some digging in order to find it. Also, there is no way of knowing if a message that was sent was ever received. After all, the other station could shut his receiver off before you came on frequency to send him a message.

Because of these limitations, hams started using WRU and Selcal. WRU is a special non-printing control character that causes a properly equipped RTTY machine to send out an identifying message every time the character is received. In order to use WRU legally, there has to be a licensed control operator at the station; this limits its usefulness a great deal. Selcal is a selective calling system. It activates the TTY machine when a specific sequence of letters, usually the last three letters of the station's callsign, is sent. The TTY will remain active until another series of characters, usually NNNN, is received. Selcal is a very useful item, but it is prone to false start-ups and not too many hams have the proper equipment to use it.

A few years ago, when microcomputers were first getting very popular, RTTY mailboxes started popping up across the country. These systems enable a ham on RTTY to leave a message in a computer's memory. The message is then received when the station to whom the message was directed checks into the system. In order to use a mailbox, no special equipment is necessary. Anyone who can get on 60 wpm Baudot (45.45 baud) can use most of the systems that are around.

The procedures for using the various RTTY mailboxes vary from system to system; the one I will describe is that of the Uncle Floyd Radio Club, WA2DCS, which is based in Queens, New York. The operation of this system is roughly the same as the other ones I have tried.

In order to check into

```
UFRC MAILBOX LOG FOR 4/4/81

STATIONS USING THE SYSTEM TODAY:
CALL            TIME
KB2WS           900
KI2U            937
AF2M            1734
WB2VTN          1753
KI2U            1801
WB2HLK          1822
WB2JUF          1849
WA2NDV          2001
KA2BQV          2034
KA0BYW          2056
WB2LWJ          2119
KA2GNJ          2148
KB2UF           2159
WA2DCS          2223
KI2U            2320
KB2UF           243

THERE ARE 37 MESSAGES IN MEMORY.

END OF REPORT.
```

Fig. 1. The log of system-usage that can be printed on the system's local printer.

the system, one gets on frequency and sends a mark tone for about five seconds followed by a bunch of Vs. It will automatically switch to either 60 wpm Baudot or 110 baud ASCII depending on what the computer hears on frequency. After the station trying to check in drops his carrier (the system is on 2 meters), the computer will send the following message:

UFRC MAILBOX (date)
THANK YOU FOR CHECKING IN. WHEN THE CARRIER DROPS, PLEASE SEND YOUR CALLSIGN FOLLOWED BY CR LF.

If the station replies properly, the system will ID in CW, and send a message such as:

UFRC MAILBOX (date)
YOU ARE USER NUMBER 56 FOR TODAY. 23 MESSAGES IN MEMORY AT THIS TIME.

If there are any messages in the computer for you, you will then see something that looks like this:

MESSAGES FOR KB2UF.
FROM KI2U—JON,
MEET ME ON 21.390 AT 10 PM (date) 1717.
FROM AF2M—HEY JON,
THE REPEATER IS UP AGAIN BUT I'M SURE YOU COULD CARE LESS. I'LL MEET YOU ON CHANNEL 19 TONIGHT. THREES TO YA! (date) 1345.
END OF MESSAGES.
(CW ID)

Note that the message is preceded by the originating station's callsign and followed by the date and time that the message was left. Once a message is called up in this manner, it is deleted from memory. After the CW ID, the system will send:

PLEASE ENTER THE STATION FOR WHOM THE MESSAGE IS FOR FOLLOWED BY CR LF AND THE MESSAGE ON A SEPARATE LINE.
LOGOFF WHEN DONE.

```
DO YOU WISH TO INSPECT A FILE (Y OR N)? Y
CALLSIGN ?  KI2U

MESSAGES LEFT BY KI2U:

FOR KB2WS--HEY RAY, HOW WAS YOUR DAY? WHAT SAY RAY? IS EVERYTHING OK? CAN YOU CO
ME OUT AND PLAY, RAY?

DELETE (Y OR N)? Y
MESSAGE WAS DELETED.

FOR WB2JUF--MARC, MEET ME ON 21.390 TONIGHT AT 9:00 PM

DELETE (Y OR N)? N

MESSAGE SAVED.
NO MORE MESSAGES.
```

Fig. 2. An illustration of how messages may be inspected and, if garbage, deleted to conserve disk space. This feature is available only on the local terminal, not over the air.

The following is an example of how a message is left:

WA2PAK.
THE HW-30 SOUNDS FB ON THE AIR. I WAS ABLE TO GET AHOLD OF A SIXER. WANNA BORROW THAT TOO??

After the last message is sent, the station types:

LOGOFF

The system responds with a:

GOODBYE, KB2UF.
(CW ID)

This system is rather typical of most of the 2-meter mailbox systems that I have seen. There are some on the low bands; operation on them differs slightly. The 2-meter band is an ideal one for this type of operation because one does not have to worry about QRM, QRN, drifting, selective fading, and other things that plague the lower frequencies.

In order to set up a mailbox system, all that is needed is a computer with a fair amount of disk space, a medium-power 2-meter rig, a stable TU that produces a nice clean AFSK tone, and a good omnidirectional antenna at a decent height. Since every setup will differ, the software would have to be custom-written for the specific equipment involved and the needs of the club.

When writing software for such a project, it is often a good idea to start with a commercially-available program and modify it to suit your needs. This way, much time will be saved. The mailbox system described in this article uses an Apple II Plus computer. The Baudot, ASCII, and CW routines were taken from a program that had assembly language subroutines written for the various codes and an Applesoft BASIC program controlling the display, flow of control, and other such things.

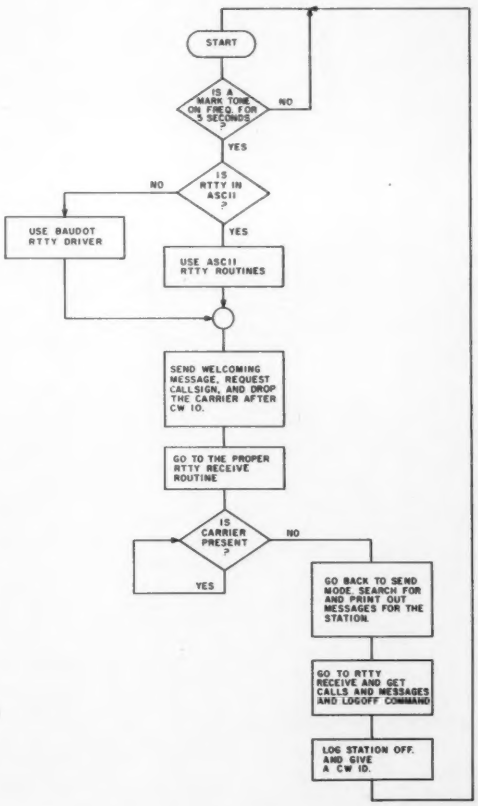

START
IS A MARK TONE ON FREQ FOR 5 SECONDS ?
NO
YES
IS RTTY IN ASCII ?
NO
YES
USE BAUDOT RTTY DRIVER
USE ASCII RTTY ROUTINES
SEND WELCOMING MESSAGE, REQUEST CALLSIGN, AND DROP THE CARRIER AFTER CW ID.
GO TO THE PROPER RTTY RECEIVE ROUTINE
IS CARRIER PRESENT ?
NO
YES
GO BACK TO SEND MODE SEARCH FOR AND PRINT OUT MESSAGES FOR THE STATION.
GO TO RTTY RECEIVE AND GET CALLS AND MESSAGES AND LOGOFF COMMAND
LOG STATION OFF AND GIVE A CW ID.

Fig. 3. Flowchart for a basic mailbox system. The RTTY send routine takes care of the CW ID. Random-access disk files are used. This limits length but greatly speeds research time.

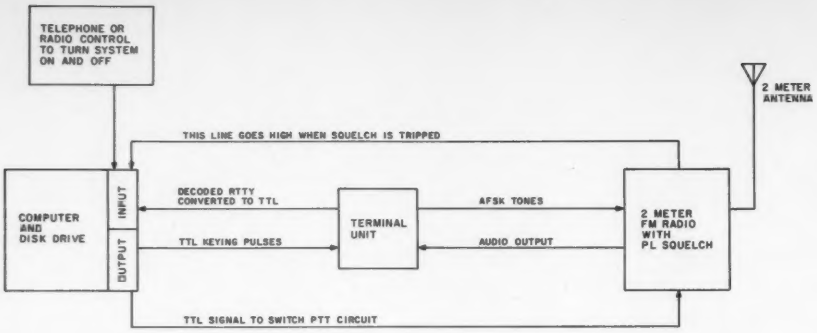

TELEPHONE OR RADIO CONTROL TO TURN SYSTEM ON AND OFF
2 METER ANTENNA
THIS LINE GOES HIGH WHEN SQUELCH IS TRIPPED
COMPUTER AND DISK DRIVE
INPUT
OUTPUT
DECODED RTTY CONVERTED TO TTL
TTL KEYING PULSES
TERMINAL UNIT
AFSK TONES
AUDIO OUTPUT
2 METER FM RADIO WITH PL SQUELCH
TTL SIGNAL TO SWITCH PTT CIRCUIT

Fig. 4. The various components in the system and their interconnections. The 2-meter rig was modified to provide an external audio output, external PTT input, and a TTL-level output line to tell the computer when the squelch is tripped.

The Applesoft executive program was modified in such a way as to enable the program to function as a mailbox. The task was not as difficult as it sounds; it took one person less than a week to perfect the program. As portions of the program are from a copyrighted program, I obviously am not able to supply a listing of the modified software. If you feel that you are not capable of writing the software, companies such as Macrotronics advertise mailbox software for the TRS-80 and other popular computers. Also, Hal makes a complete stand-alone system, with a dedicated microprocessor terminal for ASCII and Baudot.

If you decide to write your own software, it is wise to plan carefully ahead of time. Get together with other RTTY operators and decide what features you want to include and how to go about implementing them. Draw one flowchart picturing flow of control throughout the entire system and one showing which subroutines the computer should use to accomplish the task. Test your algorithm carefully to be sure it is working the way you want it to. When it comes time to actually code the program, you will find it very easy to do with the detailed planning ahead of time.

After the program is coded, test it off the air. Make sure all the functions are working as they should. You are bound to uncover many bugs during this initial testing period. When you are satisfied that the system is operating smoothly, put it on the air but be prepared to uncover many more bugs. No matter how carefully the program is written, there is always someone who will come along and enter a command that will cause the program to bomb. Hams are very talented in their ability to discover oversights in programs of this nature by entering stuff the programmer never anticipated!

Make sure that there is a way to shut the system down at a moment's notice. You are required to have a control operator monitoring the system at all times. Some means of shutting off the system on another frequency or over the phone line must be provided for. In a busy area, it is wise to use PL or Touchtone™ control so that signals on frequency will not turn on the mailbox when it is not wanted. This is also necessary when you want to limit access to the system.

On UFRC's mailbox system, there are two modes of operation: the normal mode and the privileged mode. In the privileged mode, the user can store longer messages and can use certain commands that are not available to everyone. In addition to saving on disk space by limiting the number of people who can store lengthy messages, it also provides incentive for non-members to join the club and get the priviliged-user status. The privileged mode is accessed with a PL tone and the sending of some non-printing characters during the LOGON process.

The UFRC mailbox is composed of the following hardware: an Apple II Plus computer, the Disk II disk drive, a Flesher TU-170, a Heathkit™ HW-2036A, and a 2-meter ground-plane antenna. Future plans consist of using a local repeater, WB2VTN/RPT (.64/.24), to extend the range of the system. As of now the system is closed, but it will become an open system as soon as we get enough extra disk storage to handle more users. Presently, there are about 20 active users. The system can hold about 150 average messages. You can hear the UFRC mailbox on 145.71 or the alternate frequency, 144.19. The call-sign used is WA2DCS, the UFRC club call.

Please note that the mailbox design presented here is not the only possible design. There are many different ways of designing a RTTY mailbox system. Since there aren't a great many of them around, there is still much to be done in the area of hardware and software design.

More advanced systems often have additional features. For example, it is possible to include a library of RTTY art, club announcements, and ham-related news items. As quick and reliable mass-storage devices decrease in price, the capabilities of such systems will most likely increase dramatically. The ideal system would have full duplex capabilities so that the user can interact with the computer more easily. In order to do this, each user would have to use a separate antenna or a duplexer, and separate rigs for transmitting and receiving. If various regional systems link together, a large "ham database" could result. The packet-communications systems are especially suited for this purpose.

The UFRC system includes such special features as a log of all activity that is on the system during the day. Also, it is possible to inspect messages left by anybody and edit or delete them. This is necessary to eliminate garbage messages and to free up disk space when it becomes necessary to do so. Examples of this are shown in Figs. 1 and 2. These functions are available only through a local terminal on the mailbox and cannot be used on the air.

Figs. 3 and 4 show a sample flowchart and a diagram of the system hardware, respectively.

If you have any specific questions concerning mailbox systems or how to set one up, please feel free to write. Also, I would appreciate hearing from other owners and users of mailbox systems. ■

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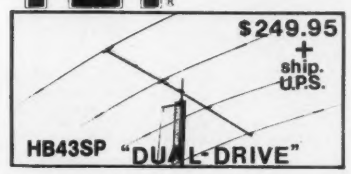

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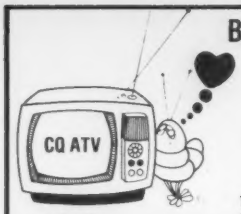

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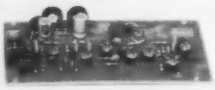

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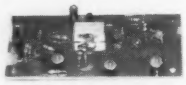

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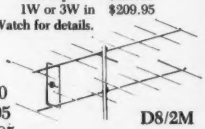

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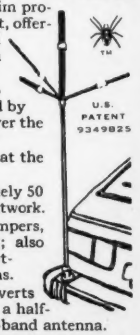

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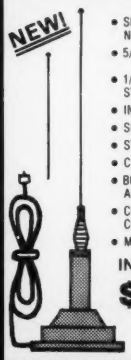

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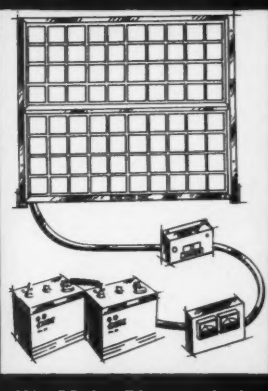

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The Morning Beverage Antenna

If you are a coffee drinker and you work 2 meters, you'll love this antenna. W4FXE shows you how to get wide bandwidths and small size at low cost.

Recently, I needed an indoor antenna for two-meter FM operation to place on the windowsill of my high-rise apartment. The λ/4 ground-plane antenna immediately came to mind but was quickly rejected because of the inconvenience of using the required ground-plane radials. Unfortunately, the 5/8λ mobile whip antenna could not be used for the same reason.

The Half-Wave Vertical Antenna

Because the λ/2 vertical antenna does not require ground-plane radials, it appeared to be the proper choice. An endfed λ/2 vertical antenna exhibits a high impedance at its feedpoint and therefore requires a transformer device to match the impedance of a 50-Ohm coaxial-cable feedline. A parallel resonant circuit will provide a fairly good match to this antenna and the 50-Ohm coaxial cable can be fed directly to a matching position on the inductance (see Fig. 1).

There are several other methods of obtaining an impedance match for a λ/2 vertical, including the familiar J antenna which has been with us for a good many years (see Fig. 2). I remember using the J antenna during the early 30s with a "rush box" superregenerative one-tube transceiver on the old five-meter band. Another method of matching the λ/2 vertical is by the use of the gamma loop (Fig. 3), which has been successfully marketed for many years under the name of Ringo.

I first tried the parallel resonant circuit built into a small metal project box, 4" × 2" × 1½". It worked well with a 38" vertical antenna section, but was unstable mechanically and would topple over too easily. I then built a J antenna which also worked quite well, but it was clumsy and the length (57") was too long. I tried shortening the J section to 8" and used a capacitor to bring it to resonance (see Fig. 4). This also worked well but was still too clumsy and inconvenient for a windowsill. I did not try the gamma-loop type, for I knew it would not go well with the awkward mounting.

The Coffee Can

A solution appeared: Why not use a coffee can as the base of the antenna? It would fit nicely on the windowsill and, with a little weighting, would be quite stable. However, instead of using a coil and capacitor

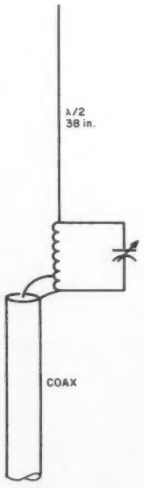


Fig. 1. λ/2 vertical antenna matched to coaxial cable, using parallel resonant circuit.

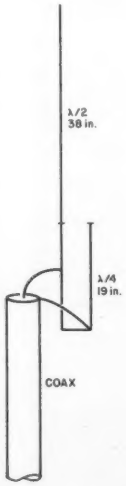


Fig. 2. λ/2 vertical matched to coax with open stub—known as a J antenna.

Fig. 3. Gamma-loop matching for λ/2 vertical antenna.

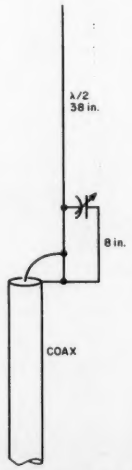


Fig. 4. Shortened J antenna.

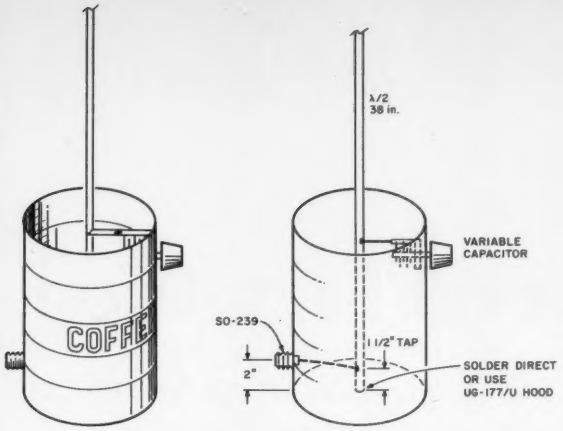


Fig. 5. The λ/2 coffee-can antenna.

as the parallel resonant circuit as shown in Fig. 1, I decided to use the *can* itself as part of the resonant circuit in a *coaxial* configuration. Being less than a λ/4 in length, I could tune it to resonance with a small variable capacitor (see Fig. 5).

The top end of the inner conductor, where it is tuned to resonance with a small variable capacitor, is a high impedance point and provides a good match to the bottom end of the λ/2 vertical antenna section. The bottom end of the can, where the inner conductor is attached, is a very low impedance point . . . comparable to the bottom shorted end of the J antenna. A good impedance match to the 50-Ohm coaxial cable can be obtained at about 1½" from the bottom end.

Usually, a coaxial resonant circuit of this type exhibits a very high Q. However, by feeding the λ/2 vertical section directly at the high impedance point and by attaching the 50-Ohm feedpoint directly to the inner conductor, the circuit is loaded down, reducing the Q considerably.

Construction

The drawing is self-explanatory. A 50-pF variable capacitor of the APC type (or equivalent) with either a screwdriver adjustment stub or a knob shaft may be used. Make certain that the rotor wiper contact is clean and makes good contact and connect it directly to the inside surface of the coffee can. Run a short, rigid copper wire from the stator plates to the inner conductor as shown. If a screwdriver adjustment shaft is used, solder a jumper wire from the non-rotating portion of the tuning shaft to both mounting studs as shown in Fig. 6. If a knob shaft is used, make the opening in the can smaller so as to make a tight fit around the shaft. This is done in either case to avoid annoying hand capacity.

The inner conductor can be made in one 43½" length so that 38" of vertical antenna (λ/2) will be exposed above the top of the can level. Copper or brass tubing, ¼-inch o.d., will result in increased bandwidth, although ⅛-inch tubing or solid hard-drawn copper, no. 8 or even no. 10, may be used.

If desired, with a little ingenuity, the antenna section can be made telescopic for convenience. An easy way to attach the inner conductor to the bottom of the can is by soldering it to a socket hood (UG-177/U) as shown in Fig. 7. You can also make an opening in the bottom of the can for a tight fit with the inner conductor and solder it there securely. With the attachment to the stator plates of the variable capacitor, the inner conductor is quite rigid.

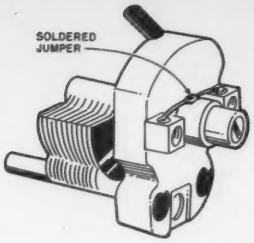


Fig. 6. APC type variable capacitor showing shaft housing jumper soldered to mounting studs.

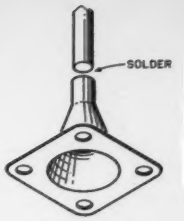


Fig. 7. UG-177/U hood.

The SO-239 socket is mounted as shown about two inches from the bottom of the can and fed with no. 16 copper wire to a position on the inner conductor about 1½" from the bottom.

Operation

The operation is quite simple. Simply place an swr meter at the antenna base and feed with any convenient length of 50-Ohm coaxial cable directly from the two-meter transceiver (see Fig. 8). Adjust the variable capacitor for the lowest swr at the most used frequency. If the swr does not dip down to a very low reading, move the coaxial-cable tap on the inner conductor up or down a little until the swr is practically at unity. You can leave the swr meter in the line for subsequent adjustments if needed. If not, you can remove it and retune when necessary for maximum received signal strength or with maximum response on a small field-strength meter.

The bandwidth of the antenna is about 2 MHz. You should tune the antenna for a most used center frequency and when shifting frequency about 1 MHz either side, the swr should remain under 1.5:1.

Because of its size, the coffee can provides a nice, stable base. However, it should be weighted down for additional mechanical stability. I live near the beach, so I filled the can with assorted shells that were cleaned thoroughly. You can also use colored glass marbles such as those used decoratively in fish tanks. When the coffee can is filled with the above, slight retuning may be necessary.

A final note: It is good practice from a health viewpoint not to stay too close to the strong rf field of any VHF antenna . . . especially if you are using more than 10 or 15 Watts. ■

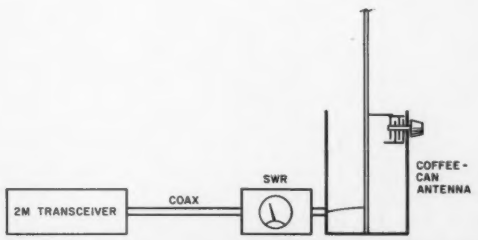


Fig. 8. Test setup for tuning the coffee-can antenna.

Try Out a Low-Level Lazy Loop

It may be only 10 feet up, but this aerial is no worm-burner. Better still, it will fit almost anywhere.

Jim Gray W1XU
73 Staff

The loop antenna is well known, with many variations including the quad loop, the delta loop, and the twin loop. Loops have a reputation of being easily tuned, forgiving of slight mismatch, broadbanded, balanced, and immune to QRN. Many antennas are really loops in disguise; if you don't believe it, consider such diverse examples as the folded dipole and the rhombic.

The "lazy loop" is basically a standard loop antenna arranged horizontally above ground, but at an unusually low height—less than one-tenth of a wavelength, for example. Before you protest that such antennas are earthworm warmers, let me recount some of my experiences.

About two sunspot cycles ago, give or take several years, I was blessed with a typical suburban lot measuring about 75 feet by 200 feet, ideal for a longwire or a collinear, antennas that need little "width" to perform their function. However, I was unsatisfied because I couldn't have that antenna farm we all dream about. You know the one: rotatable rhombics on 160 meters and that kind of thing.

Financial limitations, physical restrictions, and neighborhood censure all discouraged tall towers, large supporting structures, and *wires* (*visible* wires, at least). A lot of digging and poking in the literature kept bouncing me back to the original concept of a horizontal loop, but I could find very little information available on full-wave horizontal loops. Rhombics, yes; full-wave loops, no.

I reasoned that a full-wave loop, horizontally arranged, would use the earth as a reflector of rf energy, and the better the ground, the better the reflection. After all, vertically-mounted loops use other loops, screens, and even linear elements as reflectors, so why not the ground itself? The only drawback I could see was that my soil conductivity (which determines the quality of the "image" antenna or the reflective quality of the earth) was very, very poor. Dry, sandy soil is a poor conductor but a good absorber of rf energy. The only hope I had was that the water table was close to the surface and might provide the needed reflection before too much energy could be absorbed by the earth.

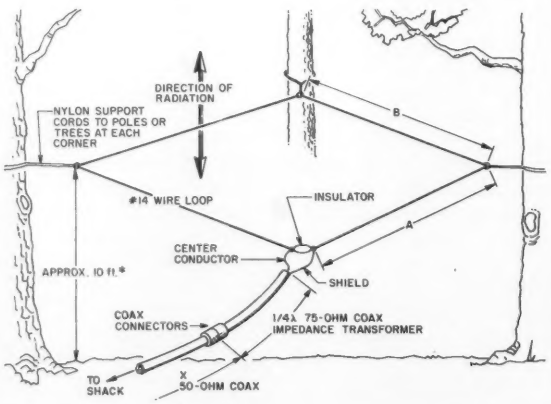


Fig. 1. "Lazy loop" 40-meter loop antenna. A = B if loop is square; 2A + 2B must equal a full wavelength (see text for formula). X = any convenient length of 50-Ohm coax to the shack. The proper 50-Ohm, non-reactive load appears at the end of the quarter-wave section of the 75-Ohm coax. Note: If nylon cord is used to support the loop at the corners, an insulator is needed only at the feedpoint.

It seemed to me that by squirting the signal skyward I could maximize the amount of rf reaching the ionosphere directly overhead and increase the amount re-reflected earthward to enhance my signal at my friends' receivers. Thus the 80-meter horizontal loop was born, with 70-foot sides, supported by TV-mast tubing at about 30 feet above the ground.

Various antenna books quoted the feedpoint impedance of a full-wave loop as being close to 110 Ohms. A quarter-wave transformer of 75-Ohm coaxial cable would change that value to about 50 Ohms, or close enough for my transmitter output impedance. So, a quarter-wave piece of 75-Ohm coax (okay, maybe it was 72-Ohm) of the RG-59/U persuasion was cut to the desired operating frequency.

The reflected power turned out to be very slight and the finals (a tube-type rig) were well-pleased. What about the forward (upward) power? Well, it seemed to come back enhanced as expected because I received lots of reports that my signal was the best ever put out by my Viking Ranger on AM phone; many reports later, I was forced to conclude that the antenna was a huge success. Stations from about 300 miles around all told me that I had greatly improved my signal and that they had noticed much less fading. I, too, noticed a big difference: The band was much more quite. On 75 and 80 meters in the summertime, you know what that means.

Everything seemed to work better than I had hoped, so I tried loading the antenna on other frequencies and bands . . . but without much success. Then I exchanged the coaxial feedline for open-wire feedline and through a tuner loaded on other bands without much difficulty. The antenna proved to have bidirectional properties and even some gain on fifteen and twenty meters. I tried changing the loop configuration (but not perimeter length) from a square to a triangle and even to a rough circle, all without any noticeable difference in performance or loading on the fundamental frequency.

I decided to bring some of the ideas along to a new homestead with a larger lot, but a set of new limitations: It is covered with trees! Not wishing to destroy the natural beauty of the place, I decided to put up the loop and use the trees themselves for support. This time, a loop for forty meters was indicated. The trees made nice, conveniently-located supports, and I was able to achieve a reasonable facsimile of a quad loop, horizontally arranged about ten feet above the ground. A possible advantage of this location was better soil conductivity, and while the trees represented a possible source of signal absorption, I hoped that the advantages and disadvantages would balance each other out, yielding a net positive result.

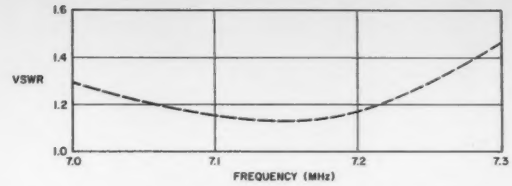


Fig. 2. Vswr at the transmitter end of quarter-wavelength, 75-Ohm matching section. (Measurement made with "MARS" bridge.)

And so it turned out. The quarter-wave matching section was cut, trimmed, and installed, and the first calls made. Results are uniformly good out to a distance of about 600–700 miles. (I have a 40-meter roof-mounted groundplane antenna for direct, switchable comparison.)

Why, then, use a loop? Well, to me, the reasons are manifold. It is easy to put up—takes maybe an hour, if you're slow. It is unobtrusive—invisible to neighbors. It gives great local performance, with reduced noise pickup. It has balanced feed and a balun is not necessary. It has simple impedance matching, and the low height means a minimum of support structure is required. Finally, it has a low cost.

Building Your Own Loop

You will need some wire, some coax, and enough room to put up the loop of your choice. Here's how you calculate the loop size (remember that you can make a square, triangle, or other polygon, regular or irregular). Use the formula $1005/f_{(MHz)}$ = total wire length in feet.

Example: You wish to put up a loop for 7.1 MHz. The formula gives a length of 141.54 feet. If you cut it to 141 feet 6 inches, you will be close enough.

The coax length is calculated by the formula: $246vf/f_{(MHz)}$ = length in feet. The vf is the coax velocity factor, which simply means that radio frequency energy travels at a different velocity in coax than it does in free space. The effect of this is that the electrical length of a quarter-wavelength of coax is different than the physical length. A common value for coax is vf = .66, and this is the value I used to cut mine. (It would be better to use a grid-dip meter to "prune" yours to the exact length needed.)

The formula for a 40-meter antenna, then, is $(246 \times .66)/7.1 = 22.87$ feet. If you cut it to 22 feet 11 inches, you'll be close enough. If that length is not enough to reach from the antenna to your transmitter, you can add any needed amount of 50-Ohm coax in series.

The coax you have cut is known as a quarter-wave matching section; it matches the impedance of the loop (110 Ohms) to the impedance of the source (50 Ohms). The quarter-wave matching-section technique requires that the matching impedance be the "mean" value between the "extreme" values. It is calculated as: $M = \sqrt{S \times L}$, where M is the impedance value of the matching section, S is the source impedance, and L is the load impedance. Thus, $M = \sqrt{50 \times 110}$, or 74.16 Ohms. As you can see, either 75-Ohm or 72-Ohm coax (or other) line would provide a good match.

Performance of the Loop

In my own loop for forty meters, I find that the swr is less than about 1.4:1 over the entire band! I know this sounds phenomenal, but I cannot measure *any* reflected power at the design operating frequency! For stations within about 500 miles or so from my QTH, reports are always in favor of the loop over my comparison vertical (Hy-Gain 14AVQ, roof-mounted with two radials per band—except 40 meters, where I use 4 radials). The signal strength difference has been from nothing to as much as 2 or 3 S-units.

For close-in stations, the loop is clearly superior; for medium-distance stations, it is sometimes better and sometimes worse than the vertical. For long-distance stations, the vertical is always better by an S-unit or two. However, there is a very interesting phenomenon, even at night or at long distances: Selective fading often drops the received signal strength, and it is nice to be able to switch antennas and bring the signal up again in strength to its former level. In fact, diversity reception is a big advantage of using a loop with another type of antenna.

As far as DX is concerned, another antenna would probably be better, although I have worked European DX with the loop and have received good reports.

All in all, the antenna is advantageous for its low cost, simple construction, and excellent performance. This weekend I plan to put up an 80-meter version. Why not try one yourself? I know you'll like it. ■

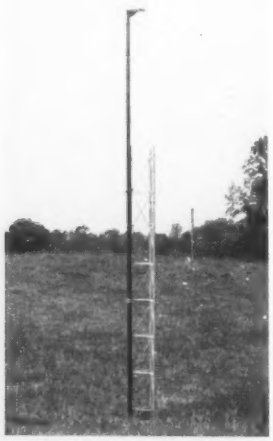
Henry G. Elwell, Jr. N4UH
Rt. 2 Box 20G
Cleveland NC 27013

Gin Pole for Peanuts

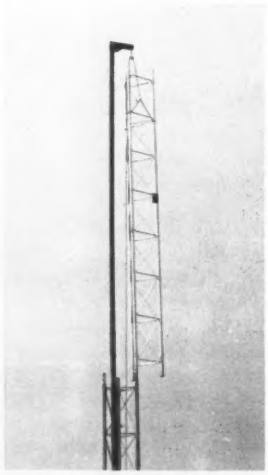
Ever pull yourself up by the bootstraps? Build this gin pole and let it do the same for your tower.

Have you ever wanted to put up a tower that uses 10-foot sections that bolt together from the ground up, like those in the Rohn 25G tower? Well, I did. Could you have borrowed somebody's gin pole to accomplish the task? I couldn't. Did you want to pay about $150 to buy one? I didn't. So what *did* I do? I built my own for $19.15 plus a little welding of scrap iron done for me by my friend, John Boger. (The welding isn't necessary if you prefer to do some drilling and bolting.)

But I'm ahead of my story. Not wanting to re-invent the wheel, as they say, I reviewed all the back issues of *73, CQ, HR,* and *QST* magazines on hand and found only one reference to making a gin pole—in which the method of attaching it to the tower was too complicated for me. However, in my reference search I came across articles on gin poles used to erect towers by means of leverage principles, which leads me to believe that they are the real gin poles.



Initial position of gin pole with U-clamps loosely connecting it to a tower leg.



Here is a section hoisted up and the rope secured, prior to climbing and bolting to lower section.

Item	Cost
25' thin-wall black pipe, 1⅝" O.D.	$14.50
4 U-clamps, 2⅜" × 4½"	2.76
1 pulley about 3" diameter	1.89
Scrap metal	0.00
	$19.15

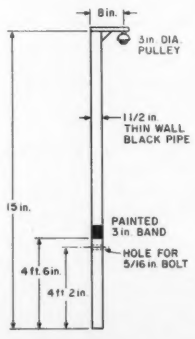


Fig. 1. The gin pole.

Gin-Pole Fabrication

The materials I purchased are shown in Fig. 1. Fifteen feet of pipe is all that is really needed, and Fig. 1 shows how I fabricated the pole.

John took a piece of 1" × 1" × 9" angle iron and welded it to the top of the pipe. He then made a metal triangle with the 90° sides 2" × 3" and welded it to the pipe and angle iron for strength. My task was to drill a hole in the angle iron for the pulley, drill a hole in the pipe for a bolt (use to be explained later), and paint a band around the pipe for an alignment mark. The gin pole

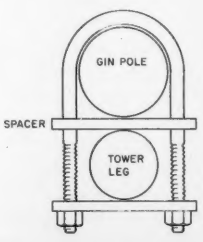


Fig. 2. Upper clamp.

weighed 25 pounds, which was light enough for one man to handle while erecting a tower.

Using the Gin Pole

Let's see how we use it, starting with the first ten-foot section of the tower secured to its concrete footing, and the rope, quarter- or half-inch nylon or manila, already threaded through the pulley on the gin pole.

Step One. With the gin pole on the ground but vertically against the tower, two U-clamps are loosely connected around the tower leg and gin pole. The upper clamp should be positioned between the first and second top tower rungs. The lower clamp should be positioned between the third and fourth rungs.

Climb to the top of the 10-foot section, safety-belt yourself in place, and lift the gin pole so that the painted band is at the level of the tower top. You will see that the hole drilled through it is at a level so that you can stick a 5" bolt through it and rest it and the pole on the top rung of the tower. The two clamps can now be tightened.

At this point it is appropriate to indicate that the two clamps are slightly different. The upper part of the gin pole cannot be snug against the tower or it will be difficult to insert the next section. A slight displacement of the gin pole from the vertical is required to prevent interference between the gin pole and the new section to be inserted. Fig. 2 shows how a spacer is inserted in the upper clamp between the pole and tower to provide the necessary vertical displacement. The spacer can be a duplicate of the outer locking bar.

Step Two. Return to the ground and tie one end of a rope to the top of the next (the second) section. From the ground, pull the second section up until it is slightly lower than its final resting place and tie the rope—see the photo.

Climb to the top of the first section again and safety-belt yourself in. You can now pull on the rope to raise the second section high enough to clear the first section, and then lower onto the first section. The second section can now be bolted to the first section.

Step Three. Climb the second section, loosely connect two more clamps (spaced on the second section as the first two were on the first section). The top clamp again has a spacer in it.

The bottom clamp on the first section can now be removed; loosen the second clamp up and let the gin pole slide down a few inches until the pulley bracket rests on the top of the second section. The other first-section clamp can now be removed.

Climb to the top of the tower, safety-belt yourself in, and raise the gin pole again so that the painted band is aligned with the top of the tower. Slip in the 5" bolt to prevent the gin pole from slipping down, and tighten the two new clamps.

You are now ready to follow step two again, and by an iteration of steps two and three and putting in the guy wires at the appropriate levels, you can go as high as the recommendations for the tower permit.

It would be very nice to say you put the tower up all by yourself, and you can. However, practical considerations, especially safety, say, "Have a ground helper as a minimum requirement!"

Some Suggestions

- All tower sections should be assembled on the ground to make sure the sections go together.
- Top and bottom of each section should be numbered or given a distinctive mark identical to the number or mark on the end of the next section to make certain they are properly assembled.
- Put a little vaseline inside the bottom of each tower leg to facilitate its sliding over the section below it.
- To permit each section to hang vertically when being mated, tie the rope under the second rung down, on each side, with the rope coming up the middle. *Align the numbered tower leg with the matching erected numbered leg before starting to raise the new section.*
- When mating sections, be sure the rope remains outside the tower sections; the rope can inadvertently be caught inside the tower leg, and it's a nuisance to have to pull the free end through the whole tower to clear it.

At completion of the work and when ready to remove the gin pole, loosen the two clamps and (as done before) let the gin pole slide down until it is resting on the top section. Then remove the rope from the pulley, tie it to the top of the gin pole, and, for safety, tie the gin pole to the tower while you climb down for a moment to remove the clamps. Be sure to wear gloves as you lower the gin pole down with the rope. Otherwise you may burn your hands from rope friction.

Temporary guying will give you a better sense of security after passing one permanent-guyed level before reaching the next permanent-guyed level. A good rope is sufficient for that purpose. It will require over 500 feet of rope to erect the 10th section of a 100-foot tower (when three-point guying at the 85-foot level), considering that you need a minimum of 200 feet of rope to get that last section up there. Have enough available for your tower height.

After putting up 370' of tower by this method, I found that it's easier than I had thought. You will, too! ■

Reference

"Safe Tower for a City Lot," Lewis H. Abraham W6FHR, *QST*, August, 1958.

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Coax Connector Workshop

Tracking down feedline-related problems can make strong men cry. By starting out right, you can avoid hassles.

Picture this setting: You're sitting in the shack one evening having a good rag-chew with some friends when suddenly your whole station goes bonkers. You wonder what happened.

You check around the shack. Your rig seems to be putting a good signal into the dummy load and all the other connections look good. Yet, somehow, the signal has just gone away.

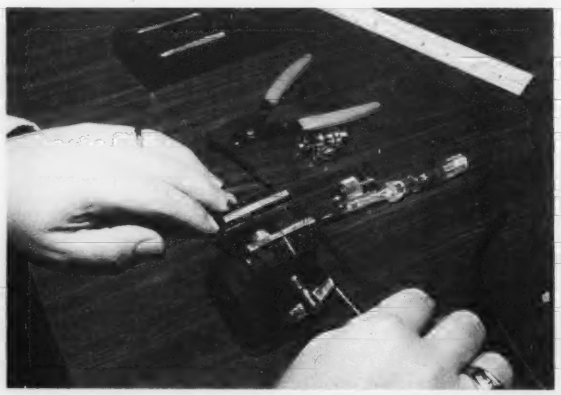
Sitting there, pondering the problem, you think: "It must be in the antenna—it can't be anywhere else. After all, the coax is new, I installed it only last week, and all the fittings and connections are okay!"

So, you're off the air, with no signal, and the next weekend comes. You check out the antenna, but everything seems okay there, too. What's the problem? "It has to be in my rig because everything else is okay. My meter is just probably giving me a false reading into the dummy load!"

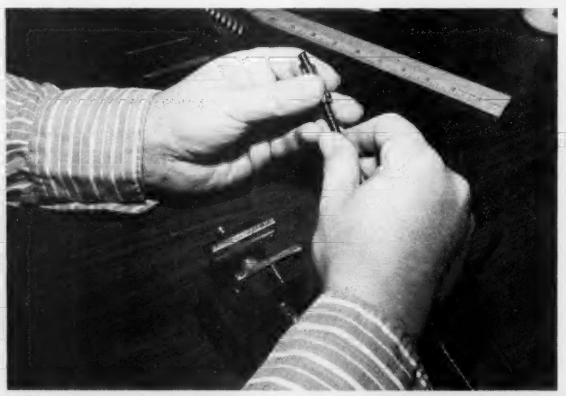
But, wait a minute! Before you haul out the rig's shipping carton and send it off to the manufacturer, there may be one area that you've missed.

Remember that new coax you just installed? Have you checked it out, too? The answer to this one is probably no, because you know how to cut coax, right? Well, just to be sure, check out the coax, too!

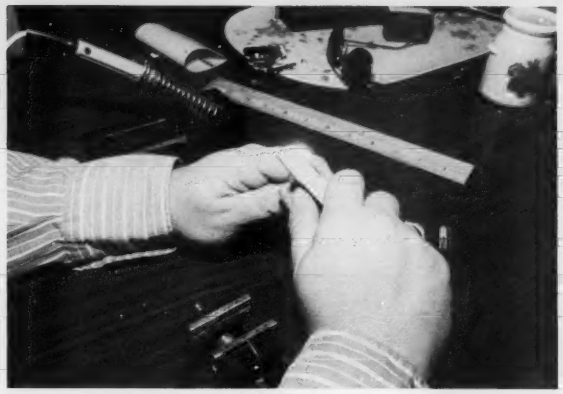
"Okay," you might think, "I might as well check out the coax, too, although it can't be bad. I know what I'm doing with coax!" So, you take the coax down and check it with your VTVM or DMM and you see that there's no continuity. "Something's fishy here!" you



It's always a good idea to lay out the tools and parts you will need to cut coaxial cable before beginning the operation.



The first step in preparing this RG-58 cable for cutting is sliding the UG-175 adapter over the cable. This allows the use of a PL-259, which is actually sized for RG-8/U coax.



Cutting the outer covering of a piece of coax requires a sharp knife and a firm but gentle score around the plastic covering. If you cut too deeply, you risk cutting the outer braid of the coax.

Once the layer of covering material is removed, you will find the tightly twisted shield braid exposed. Here you can see the exposed braid and the UG-175 adapter.

think. You then check it out for shorts, and instead of reading infinity, your meter gives strange readings.

Voilà! You've just solved your problem. The coax was improperly cut.

Improper coaxial cable preparation is probably responsible for more problems in amateur radio than any other single cause. Unless you buy your coax precut with the fittings installed, then chances are one time or another you're going to run into problems with poor cable connections.

This need not be the case if you take some time and work slowly and thoroughly. Proper preparation of coaxial cable and the fitting of the connectors is a relatively easy, straightforward job.

The tools needed for this job include: a sharp knife, hobby knife, or razor blade; an awl, sharp scribe, or ice pick; the cable; the fittings (PL-259 or BNC) and adapters (if needed); about a 60-Watt soldering iron (it can be less, though); and solder.

Once you have the tools laid out, it's time to begin the actual process. The first step involves slicing through the outer jacket of the coaxial cable. Whatever you do, don't carve the cable like it was a turkey because you're going to score or nick the outer shield braid of the cable; if you do this, then you're on your way to a short. So, be gentle when you first slice into the outer jacket of the cable. Just slice it far enough to expose the inner braid. Once you have done this, the jacket should slip right off and expose the braid itself. Remove about 3/4" of the outer jacket.

The braid is another area where many amateurs make mistakes. Too often the braid is merely pushed back down over the cable to expose the inner dielectric. Or, worse, a hole is made in the braid and the inner conductor is merely pulled through. In some cases, this is fine, but in most cases, it isn't. What is needed is patient debraiding of the shield braid.

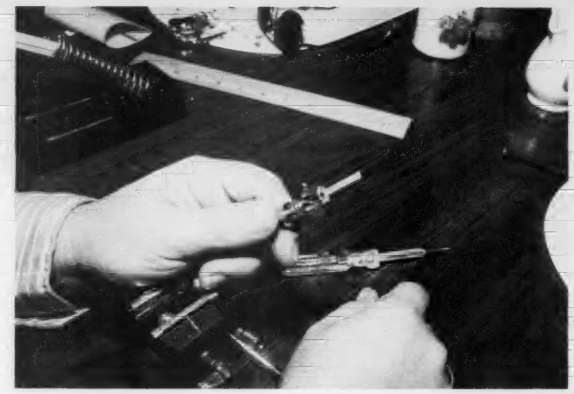
But, before you get to this point, it is wise to install the various fittings which belong on the cable. This includes the barrel of the PL-259 and the adapter (UG-175 or 176) if you are using cable that's smaller than RG-8/U. I like the Radio Shack mini-foam RG-8 myself. The beauty of it is that it is nearly as small as RG-59/U, but is much less lossy.

Once the fittings are installed, wiggle the braid a bit to loosen it from the in-

The next step in preparing coax is carefully debraiding the outer shield. For this you will need a sharply pointed scribe, ice pick, or other pointed tool.

When you have finished debraiding the outer coaxial shield, it should look like this. Notice it is fanned at roughly a 90° angle. This fanned braid is then smoothed over the adapter and trimmed.

After the coaxial cable's outer braid is smoothed over the adapter, it is then trimmed. It should be trimmed so the cable covers about 50 percent of the adapter's barrel. A pair of mini-snips makes short work of this.



With the shield braid trimmed, the soon-to-be-completed coaxial cable fitting should look like this. The trimmed braid is smoothed over the adapter and the center conductor's insulation is exposed. The installation should look like this. One note here, even though it is not shown: The screw-on PL-259 barrel is installed before the UG-175 is installed on the cable. This barrel allows the unit to be mated to a female SO-239 connector on the back of a rig. A spare is on the table.

ner dielectric. Then gently insert the awl (scribe or pick) and start to unravel the 3/4" of exposed braid.

To debraid the cable, follow the winds of the strand bundles. Take your time and don't nick or break them because you run the risk of a short if you do. The whole job, by the way, should only take 10 to 15 minutes once you're skilled at it. Yet, however long it takes, this is one of the most crucial parts, so take your time doing it.

After the cable is debraided, spread the braid strands out at a 90° angle from the cable itself. Then take a pair of scissors and trim the braid to about 3/8". (If you're using smaller cable and need the UG-175 or 176 adapter, move it up flush with the end of the outer covering.)

Next, take your knife and gently slice into the dielectric. All you have to do is score the dielectric and pull on it. The piece of dielectric should just slide right off the center conductor. You have to score it roughly 1/8" above the point where you've debraided the outer shield.

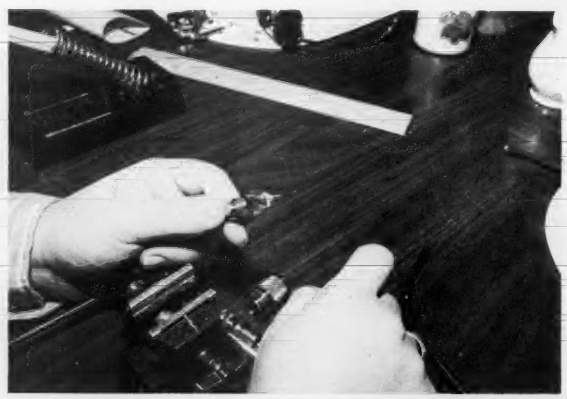
Once you've got the center conductor exposed, if it is stranded, twist it into a tight bundle and tin it with a little solder.

At this point, you're just about ready to slide the body of the fitting over the prepared end of the cable. Carefully take the plug body and insert the tinned center conductor into the shaft of the plug body.

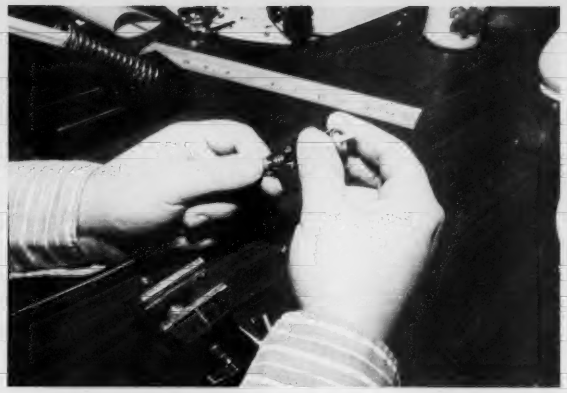
With the center conductor inserted, the next step is to twist the fitting over the end of the RG-8/U. While doing this, you also have to turn the fitting to make sure that it seats properly. You have to exert a fair amount of pressure to do this, but it should be done easily without the aid of tools. Remember, those strands of copper in the outer shield are gentle beasts, so don't use brute force.

At this point, you're nearly ready to go. It's here that the soldering iron comes into play. In the PL-259 connector, you'll notice four holes in the shaft body. These are soldering holes. It is through these that you connect the outer shield to

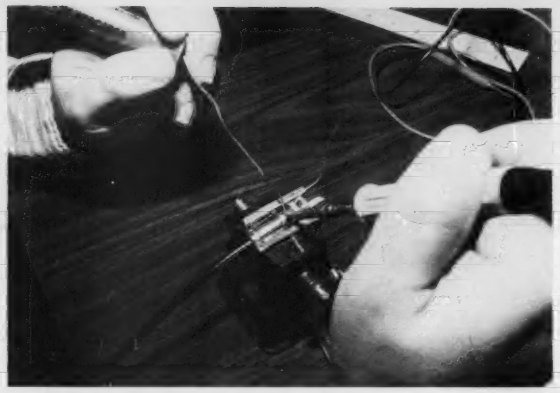
Trimming the center insulation requires careful cutting with a sharp blade. You must cut deeply enough to slice through the plastic insulation material, but not so deeply as to cut the center conductor itself. This takes practice.



With the center insulation removed, the prepared end of the coaxial cable should look like this. Notice that the center insulation is not trimmed to the same point as the shield braid. This is important because it maintains an insulated area between the braid and shield and prevents shorting.



With the cable end prepared, the next step is to install the PL-259's center fitting. This should easily slide over the UG-175 and it will then be screwed snug.



The most crucial part of the PL-259 installation is soldering the plug and coaxial shield. If you have done the installation properly, the coaxial braid should appear through the four solder holes in the body of the PL-259. Don't hold the iron here for a long time because you chance melting the little insulation left between the braid and center conductor inside the plug body itself. This means not using a low-wattage iron. A good 30-60-Watt iron should be able to cope with this task easily. This soldering also provides a good ground, which is necessary for coaxial cable.

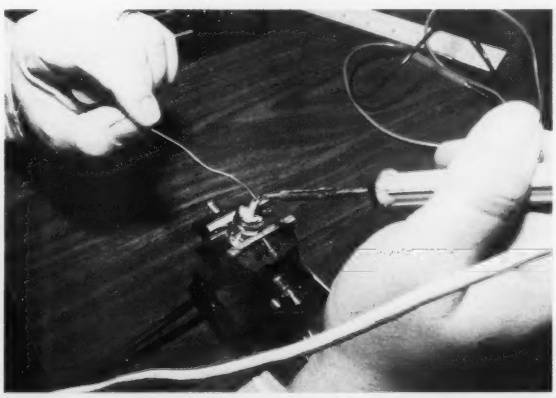
the fitting. These provide the ground for the outer shield.

Making sure that the soldering iron is hot enough and using a pointed soldering tip, apply the iron to both the hole and the shaft of the plug body. You do this by angling the iron slightly. After a couple of seconds, the braid and body should be hot enough to take the solder for a good joint. Don't overheat the braid (though it's a wonderful conductor of heat *away* from the area where you're working), because you can damage the nearby outer jacket easily, and *most importantly*, you can heat the braid to the point of melting the inner dielectric, producing an instant short! Continue the soldering process until all the plug holes are filled with solder and the connections are good. And, once you have completed this step, it's time to move on to the tip of the fitting itself.

What you'll find here is the tinned center connector inside the tip of the plug. Merely apply your iron to the tip and the center conductor and then run in enough solder to fill the shaft. Wipe it quickly with a damp sponge to remove the excess rosin.

The next step is screwing the barrel of the fitting over the body of the body itself—and you've completed the job.

If you're using smaller coax and need the UG-175 or 176 adapter, there's an extra step. You trim the braid as in using the larger-sized cable, but then you screw the fitting body over the adapter. The braid of the outer conductor will be visible through the solder holes. Once this is secure, then you solder through the plug holes just as with normal RG-8. The rest of the procedure is the same.



The last step, after the plug has cooled from the first round of soldering, is running solder into the center conductor pin. This is a hollow opening in the tip of the plug through which the center conductor should appear if it has been installed correctly. It is necessary to fill this totally with solder.

The final step in the installation of coaxial fittings is checking them for both continuity and shorts. Once you have fitted plugs to both ends of your cable and finished the work (yes, it can be tedious), take your VTVM or DMM and run these checks. To check for continuity, first set the meter to read resistance and connect the probe leads to the outer barrels of the plugs on either end of the coax. If there is continuity, you should have a zero reading on your meter. Repeat this process with the center connectors.

To check for shorts, attach one of the probe leads to the outer barrel of one plug and the other probe to the center connector of the same plug. The reading you should obtain is infinity. If you don't get the proper meter readings, then you've got a short somewhere (probably in one of the fittings) and you're going to have to remove the fitting and start all over again.

However, if you've taken your time, you should find that the readings are okay and you're ready to install the coax. That's all there is to it.

Making proper coaxial fittings may not be the most glamorous part of amateur radio, but it is one of the most important. The coax, after all, is what carries your signal to and from your antenna, and without a signal, even the best station and equipment is pretty much useless. ■

Make Your Noise Bridge Even Better

Use these shortcuts for easy calibration and give your transmitter 1:1 vision.

William Vissers K4KI
1245 S. Orlando Ave.
Cocoa Beach FL 32931

While reading the excellent article entitled "QRM-Free Antenna Tuning" in the August, 1981, issue of *73 Magazine*, I was particularly struck with the ingenious associated circuitry of Fig. 3 that allowed the noise bridge to be used also as a QRM-free tune-up device. The authors recognized a problem and offered a solution to it that will be of great benefit to all amateurs. Even more important, the technique described will prevent serious damage to your transmitter by ensuring that it goes directly into a matched load. You will keep your finals cool!

However, I did notice an error in the schematic. Also, I was able to calculate an alternative method of calibration that eliminates the need for standard inductances yet allows for a theoretically exact calibration of the entire reactance scale. My equation allows the bridge to be directly calibrated for the reference frequency of 1 MHz, thus eliminating the need to refer to either graphs or cumbersome equations. However, the graphs and equations have been shown here for information purposes.

A Correction

First the error should be corrected. In Fig. 2 of the referenced article, the 68-pF capacitor should be in series with the antenna jack as shown in Fig. 1 of this article, and *not* connected to ground as originally shown. The sectional schematic shows this correction and also has the parts labeled for identification purposes.

In order to obtain an exact calibration, rather than using the mirror-image method previously described, it will be necessary to use some small fixed capacitors for standards. Ordinary 5% silver micas or their equivalent will work just fine. The values of 10, 20, 30, 40, 50, 60, and 70 pF are used to obtain the basic calibration points. Small values of capacitance can be paralleled to obtain larger values; for example, a 20 pF in parallel with 30 pF will give a 50-pF value.

When using these standard calibrating capacitors,

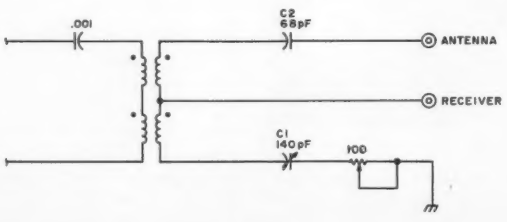


Fig. 1.

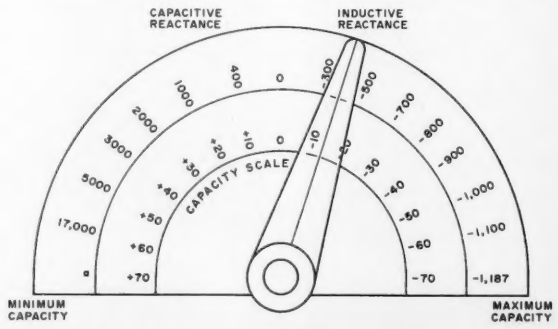


Fig. 2. Bridge scales and pointer knob.

the leads should be kept as short as possible to avoid undesirable lead inductance. As a further method of diminishing the lead-inductance effects during calibration, I prefer to do my own calibration at a low rather than a high frequency. In my own experimentation, I have used a calibration frequency of 3.75 MHz and found it to be very satisfactory. If a bridge is carefully built, the calibration should be satisfactory for the range of 160 to 6 meters.

Fig. 2 shows an outer scale in reactance and an inner scale of the standard capacitances used. (The inner scale is shown to help understand the technique used and is not needed when you actually use the bridge to measure reactance.)

Calibration

The first step is to calibrate the resistance dial of the bridge. The method previously described is correct, and no further comments are needed. When doing the reactance calibration, a 50-Ohm resistance should be connected to the antenna jack of the bridge. For my own purpose I just soldered a 50-Ohm, ¼-Watt resistor inside of a matching plug, keeping the leads as short as possible inside of the jack.

The knob on the variable capacitor should be so positioned that the capacitor is fully meshed when the knob is pointing to the right or the maximum capacitance marking on the scale. Then when the knob is pointing up to the zero point on the scale, the capacitor will be at half capacitance. With the 50-Ohm resistor connected, null the bridge. The reactance dial should be quite close to the mechanical half-point of the variable capacitor. This is called the original null point, and here C1 will have a capacitance value of 68 pF to match that of the 68 pF of C2.

Nulling is obtained when the total impedance of one side of the bridge is exactly equal to the impedance of the other side of the bridge. If the null point is quite close to the mechanical center point of the capacitor, the values can be brought to coincidence by slipping the knob shaft a few degrees one way or the other so that the knob reads zero at the electrical null. This technique will not affect the basic accuracy of the bridge when it is finally calibrated.

It could happen that if the maximum value of C1 were higher or lower than the specified value of 140 pF, the electrical null and the mechanical half-mesh point would be off more than a few degrees. In this case, the value of C2 would have to be changed to bring these two points more closely in line. If this is done, then the actual value of C2 should be recorded since its value is used in the reactance equation shown later on. If, by chance, there is a large, unexplainable difference between the electrical null and the mechanical half-mesh point, the circuit should be checked for wiring errors.

Now that the original null has been accomplished, the bridge can be calibrated. Start with a 10-pF capacitor and connect it across C2. The total capacitance of this circuit will now be 68+10=78 pF. This means that to null the bridge, the capacitance of C1 will have to be increased to 78 pF. At this null point, mark the capacitance scale as −10 pF. Now remove the 10-pF capacitor from across C2, replace it with 20 pF, and obtain and mark this new null point on the capacitance scale. Repeat this procedure until the right half of the scale is calibrated in capacitance values.

The left-hand side of the scale is calibrated in a somewhat similar manner. Place the 10-pF capacitor across C1. This means that for the bridge to be in balance, the capacitance of C1 will have to be reduced 10 pF. The null point on the scale is marked +10 pF. The 10-pF capacitor is removed and the procedure repeated for the larger sizes of calibrating capacitors until the scale is calibrated.

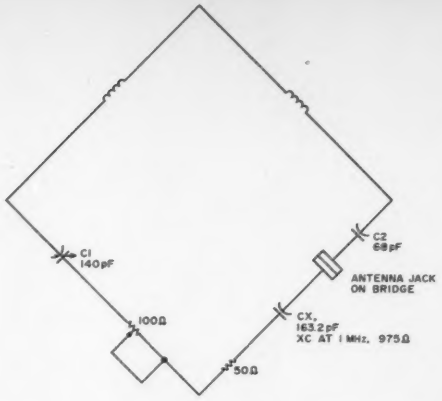


Fig. 3.

The bridge is now calibrated in terms of +C and −C, and all that is needed now is to relate these values to values of X_1 and X_C so that the bridge scale can be calibrated directly in terms of reactance. And even though the bridge was calibrated at a frequency of 3.75 MHz, a bit of calculation will enable us to calculate the scale reactance values at our originally stipulated frequency of 1 MHz.

For illustrative purposes, let us pick a series load of 50 Ohms and a capacitance reactance of 975 Ohms at 1 MHz and connect them across the antenna jack of our bridge. The schematic of Fig. 3 will make it easy to follow the mathematics involved. The actual value of the capacitor at 1 MHz is calculated and found to be 163.2 pF. The equation used is $C=1/2\pi FX$, and because F is in MHz and C is in pF, 1,000,000 is needed in the numerator. $C=1{,}000{,}000/(2)(\pi)(1)(975)=163.2$ pF.

From the circuit of Fig. 3, it can be seen that the 68 pF of C2 is in series with the 163.2 pF of the load, and the resultant capacitance of the two is from our series capacity equation, $C=(68)(163.2)/(68+163.2)=48$ pF. To obtain a null at this point, our variable capacitor would have to be set at a capacitance of 48 pF, which is actually its original null value of 68 pF minus the 20 pF calibration point for the left-hand side of the dial. (I hang my head and confess that the original value of 975 Ohms of reactance was chosen to keep the math easy and make the result come out exactly at the 20-pF point on the scale. This is what is called a planned coincidence!)

By now some of you will be saying, "Hey, if I have to go through all of that stuff every time I want to make a reactance measurement, forget it!" I couldn't blame you. But by sitting down and combining all of the foregoing calculations in a single equation, it is easily possible to just use the scale calibration values and obtain reactance values. And the basic equation is this: $X=(-j)[(1{,}000{,}000)(\text{dial setting})/(2)(\pi)(C2)(C2-\text{dial setting})(\text{frequency in MHz})]$.

(The term (−j) was added so that all values calculated will come out in the conventional engineering notation, so that capacitance reactance is −j and inductive reactance is +j.)

And now we are better

Dial	Capacitive Reactance	Dial	Inductive Reactance
0	0	0	0
+10	403	−10	300
+20	975	−20	532
+30	1848	−30	716
+40	3344	−40	867
+50	6501	−50	992
+60	17,550	−60	1097
+68	∞	−70	1187

Fig. 4.

able to see that because inductance reactance is opposite to capacitance reactance, the right-hand or inductive reactance side of the scale was marked in *minus* (−C) values.

The equation is easily checked numerically by just putting in the previous values and we shall see that we will wind up back with our value of 975 Ohms: $X=(-j)(1{,}000{,}000)(+20)/(2)(\pi)(68)(68-20)(1)= -j975$ Ohms.

It will be evident that the sign values for the capacitive scale should be observed in the equation when it is used. This can be illustrated by assuming a null reading of the C scale of −30 pF. This indicates the reactance will be inductive. The calculation is as follows: $X=(-j)(1{,}000{,}000)(-30)/(2)(\pi)(68)[68-(-30)](1)= +j716$ Ohms. And if we were calibrating our scale, the −30 value of capacitance could be marked as 716 Ohms.

And now to save everybody a lot of time calculating values either for the scale or the construction of a graph, I've included a table of values (Fig. 4) and the graph (Fig. 5) showing values of reactance vs. dial settings of plus and minus C.

The bridge is very easy to use when measuring impedance. Just connect your unknown value of impedance to the antenna jack of the bridge, make your null, and read your resistance and reactance scales. Take your reactance value and divide it by the frequency in MHz at which you are making your measurement, and you have your reactance value in Ohms. The resistance dial does not have to be divided by frequency as it reads correctly independent of frequency.

There is one easy check that you can make to show if your bridge is frequency-sensitive. It theoretically should not be, but naturally all pieces of equipment have distributed capacitance and lead inductances which make theoretical values deviate from the ones measured. The best test is by using a simulated load of a capacitance and resistance in series, and make a null measurement at some low frequency (say, 3.75) as we had originally done. Now, without touching the bridge, increase the measuring frequency to some high value (say, one of 10 or 15 meters).

You may not believe this at first, but the bridge will stay at a null position without having to move either the reactance or resistance dials. This indicates that you have a very good bridge. Practically, you might find some slight deviation in the dial settings, but they should not be excessive. This rather interesting and very useful test result is because the dial was calibrated with standard capacitances and, after all, a capacitance at 3.75 MHz has the same capacitance at 10 or 15 meters. Try it, and you will see how useful this test is in evaluating a bridge unit. It will uncover stray, unwanted capacitances and inductances and will also quickly tell you if you have some basic problem when you first build your bridge.

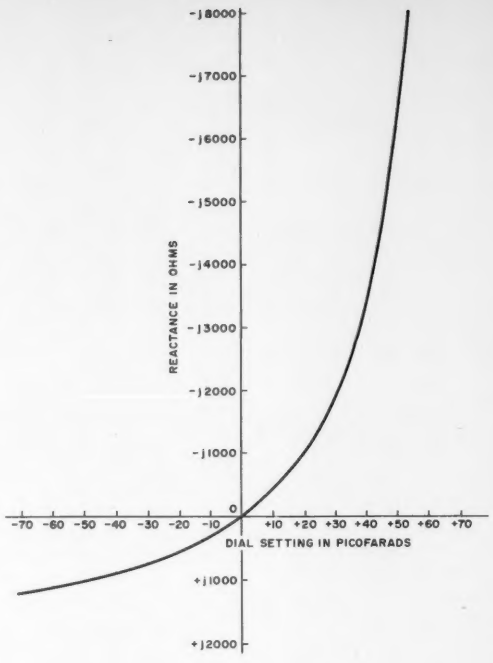


Fig. 5.

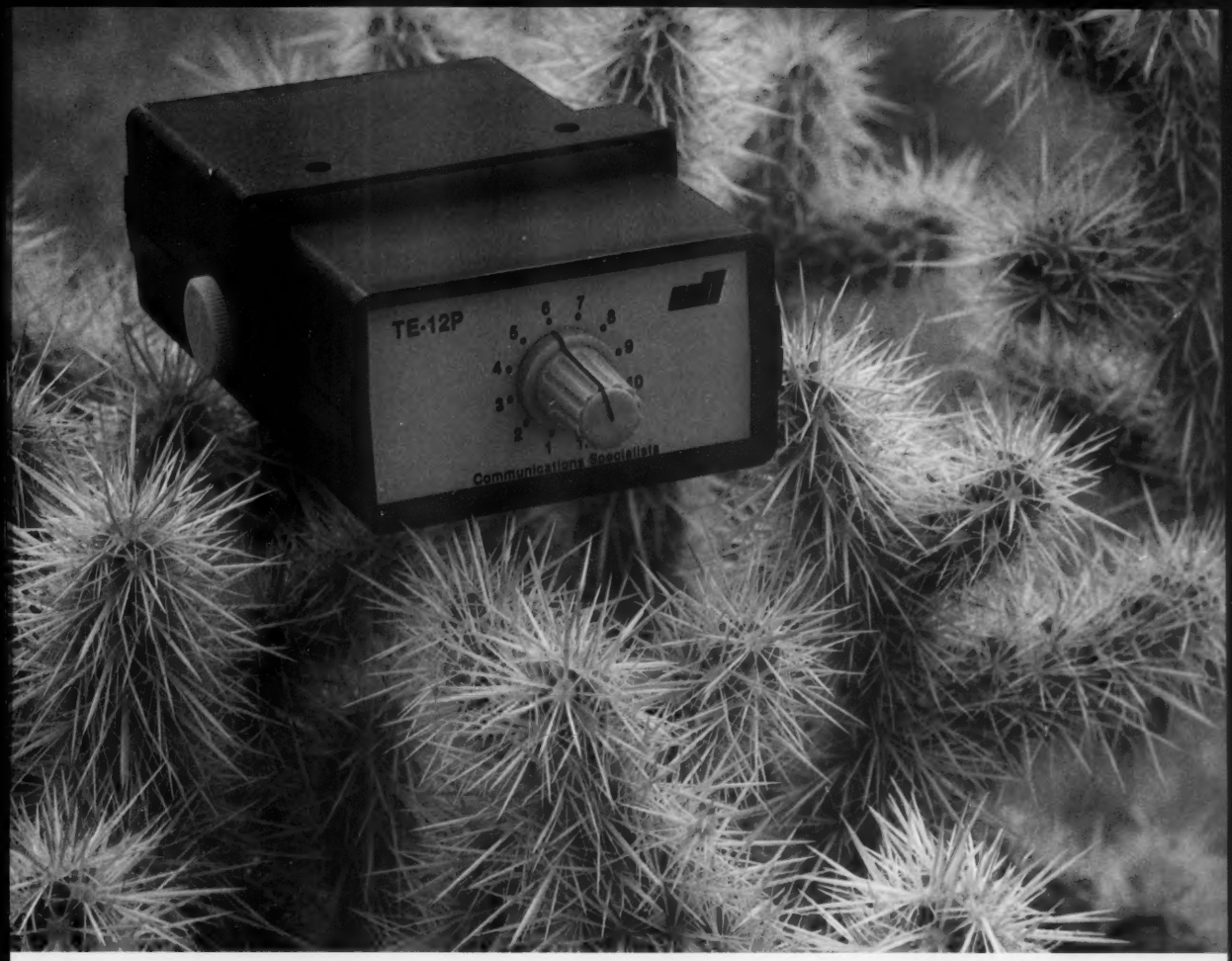
Easy Tune-Up

As I mentioned earlier, the auxiliary circuit of Fig. 3 of the original article is extremely useful as it allows you to adjust your matching network to exactly 50 Ohms, so that after you have tuned up your transmitter into your dummy load and switched over to your antenna circuit, your transmitter will have an swr of 1:1 and you are ready to go on the air. Tuning up using a matching network directly may result in a period of high swr. This can damage your equipment or, in the case of the newer transistorized rigs, cause you to lose power. So, just tune up your rig into the dummy load at fifty Ohms, then use the auxiliary circuit, tune up your matching network with the bridge, and switch over; you are ready to go on the air.

There is one final note of caution: *Never turn on your transmitter if your auxiliary switch is in position 2 or 3.* If you do, you may see some smoke! In fact, to stress this point, the instructions that accompany Palomar Engineers' noise bridge combine the warning with a picture of a noise bridge buried in a graveyard with a gravestone marked "R.I.P., R-X Noise Bridge."

Using a four-layer rotary switch, a transmitter defeat circuit could be added. Every transmitter's turn-on capability varies with the design circuit, so this protection will have to be left to the ingenuity of the individual amateur. The circuit would have to be so designed that the transmitter would operate only when the switch is in the number one position.

If you decide to buy a commercial bridge, it can be used with the auxiliary circuit. Thus, you will reap all of the advantages of having a means of measuring impedance and a means of tuning up without putting any QRM on the air, and you can tune up your rig without any chance of damage. The original article is well worth every serious amateur's thought and consideration.■



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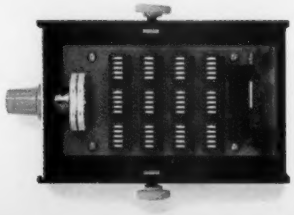

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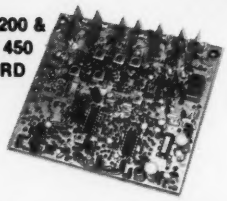

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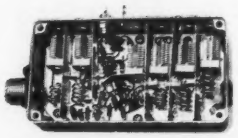

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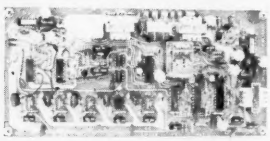

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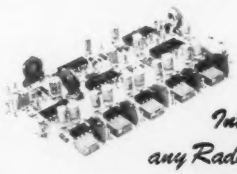

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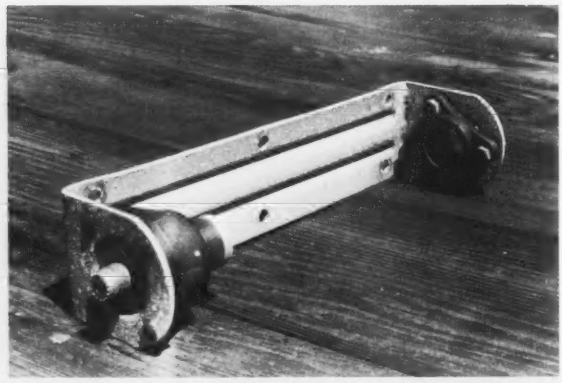
Antenna Refinishing the Easy Way

When a good vertical begins looking like a rusty downspout, it's time for some maintenance. Here's how K6EW saved a hamfest special.

Sam Creason K6EW
2940 Arlington Avenue
Fullerton CA 92635

At a recent ham swapmeet, I was able to buy a used 18AVT/WB trap vertical antenna for about half the cost of a new one. However, it had been exposed to Los Angeles air for several years, and therein lay a problem. The 18AVT/WB consists of several traps, pieces of aluminum tubing, top-hat radials, and a short metal whip. These parts are assembled telescope-fashion and held in place by compression clamps, nuts, and bolts. Over the years, the smog-ridden air had attacked the metal, making for poor contact between adjoining surfaces. Furthermore, the spacing between traps depends upon whether the antenna is to have minimum swr for phone or CW subbands, and whether it's to be mounted on a rooftop or on the ground. Without an instruction sheet, I had no way to determine the spacings. Finally, like any ¼-wave vertical, the 18AVT/WB requires some sort of ground plane or system of radials. Again, I was at a loss without an instruction sheet.

A letter to Hy-Gain, the manufacturer, brought a brochure on the antenna but no instruction sheet. A letter to 73's "Ham Help" column did the trick (thanks to WB4TCP, WB6JOP, N8ECR, WD8JFF, KØYEH, and WAØITU). For someone who is in the same position as I was, the dimensions for the 18AVT/WB and radials are given in Figs. 1 and 2, respectively. Two radials per band are required, and they must be insulated in a rooftop installation. "Egg" insulators are handy for this. Extensions to the radials for attaching to guy points must



Base of antenna. Bottom piece of aluminum tubing passes through the insulated opening (right) and rests on the insulated support (left).

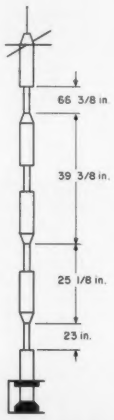


Fig. 1. Dimensions of the 18AVT/WB for CW, roof-mount. (Not to scale.)

Band	Length
40	37′ 0″
20	18′ 7½″
15	11′ 10½″
10	9′ 10″

Fig. 2. Dimensions for radials for the 18AVT/WB.

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be insulated from the radials and should be broken into shorter segments than the radials.

Once the antenna is disassembled, cleaning the various joints requires a few sheets of medium-grit sandpaper, two or three dowels ranging from ⅜" to ¾" in diameter to support the sandpaper against inner surfaces, and some elbow grease. Each mating surface should be sanded until it has a smooth satin surface. Areas where the radials make contact should also be sanded.

Having cleaned, reassembled, and installed my refurbished antenna, I tried making a contact, but to no avail. The photograph shows what I'd forgotten to clean! The lowest piece of aluminum tubing slips over an insulating block which provides vertical support. On top of the block is a disk of aluminum which is a snug fit inside the tubing and provides electrical contact with the radiating portion of the antenna. A setscrew through the tubing forces the disk against the opposite side of the tubing.

Cleaning the joint was no problem, but because the wall of the tubing is rather thin, there are only a few threads to engage the setscrew. Unfortunately, I stripped these threads while reassembling the antenna. However, a 10-32 screw saved the day. It's a little larger in diameter than the original setscrew and the threads are not as coarse. It served nicely as a self-tapping screw in the softer aluminum.

Results with the refurbished vertical have been encouraging. Although I use an HW-8 (about 3 Watts out), I've had no problem at all making stateside contacts. Finland and Japan were the best DX in the first three weeks of operation. I suspect that my vertical will get a yearly cleaning. ■

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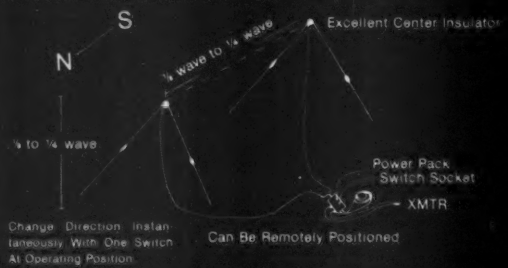

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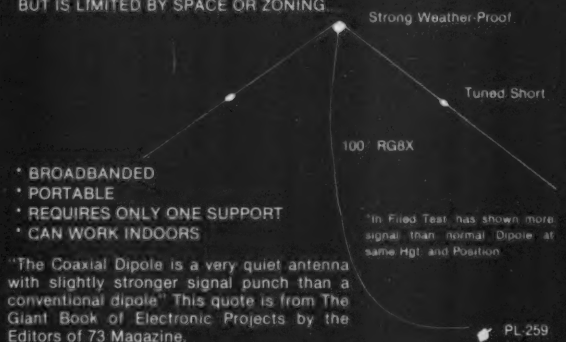

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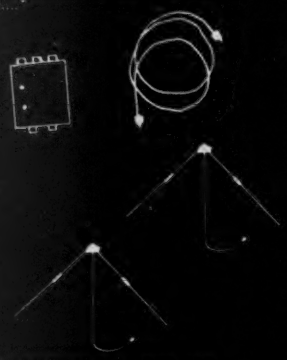

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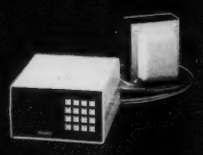

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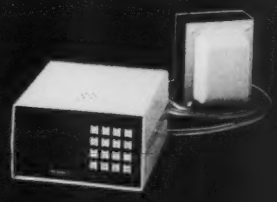

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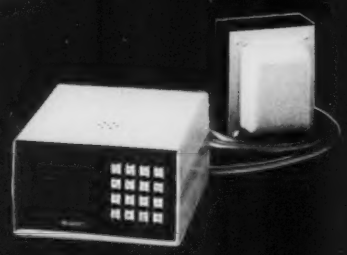

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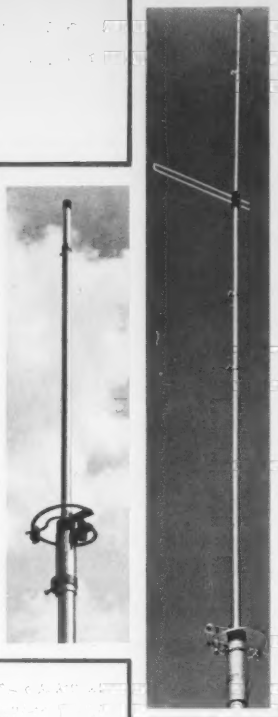

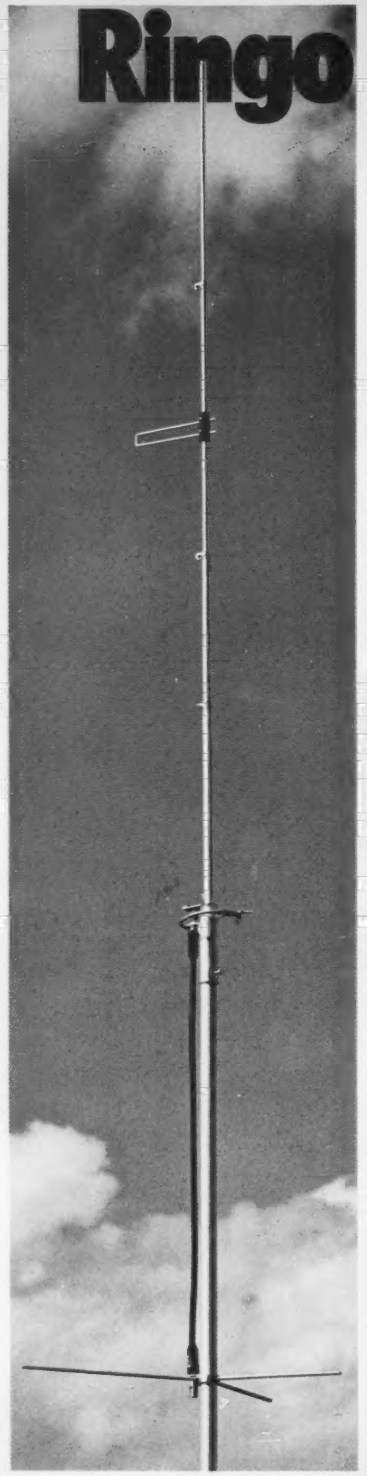

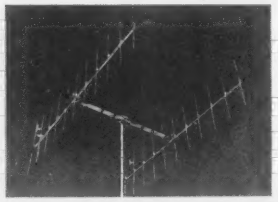

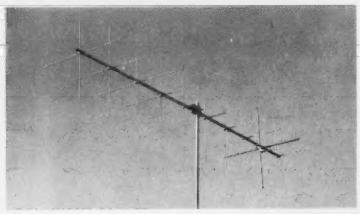

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73 INTERNATIONAL

Each month, 73 brings you amateur radio news from around the world. In this collection of reports from our foreign correspondents, we present the latest news in DX, contests, and events, as well as keep you abreast of the technical achievements of hams in other countries.

If you would like to contribute to your country's column, write to your country's correspondent or to 73: Amateur Radio's Technical Journal, *Pine Street, Peterborough NH 03458, USA, Attn: Avery L. Jenkins WB8JLG.*

PAPUA NEW GUINEA

Siegi Freymadl P29NSF
PO Box 165
Rabaul
Papua New Guinea

During January, band conditions were very poor; the 10m band appeared dead most of the time or was open only for a short while. I have been having biweekly schedules with my friend Doris N5CFP, in Garland, Texas, for more than two years, but during January we missed out on a number of occasions due to bad conditions. At times we were pleasantly surprised when she called at 2230 GMT and signals were good, but by 2300 the band closed again. We have now arranged for split frequency operation as 15m seems to be more reliable. But on that band, too, the noise level is very high.

Eighty-meter nets are still being run within Papua New Guinea. The Highlands net meets every Monday night on 3560 MHz at 0930 GMT, and another net runs from the national capital, Port Moresby, on Thursdays at 0930 GMT, also on 3560 MHz. The nets are badly attended at present, with only three or four stations checking in. According to Peter P29NUK, 80m in Port Moresby is impossible at the moment—the noise level being unbelievably high—and therefore none of the amateurs from the national capital are able to participate.

One event that the Papua New Guinea Amateur Radio Society is involved in is the Papuan Safari Road Rally, which is held annually over a long weekend marking the September 16 anniversary of independence. The rally has been going since 1979. It is organized by the South Pacific Motor Sports Club, and members of the PNGARS provide communications between checkpoints for scoring and safety. For the occasion, they are granted third-party privileges, to enable them to pass on third-party traffic on behalf of the Sports Club. Normally, third-party traffic is not permitted in PNG. The independence rally runs over three days and nights and attracts international drivers and cars.

AOCP (full call) examinations were held in PNG on Tuesday, 15 February, at the same time as in centers in Australia. It is once again possible to sit for CW exams in the center nearest to one's QTH, without having to go all the way to Port Moresby. Apparently, a radio inspector to give the examinations is now available to do the rounds again, and he flies to the towns where candidates have applied to sit for exams. It was the lack of a radio inspector that made it necessary for candidates to fly to Port Moresby and not a lack of funds! Now I no longer have an excuse for not attempting the exam.

Margaret P29NUN, "the nun on a broomstick" from Kefama Catholic Mission near Goroka in the Eastern Highlands, will be attempting the full call theory exam this time. I wonder what will happen to that very appropriate callsign when she upgrades? Sister Margaret is an Australian Sister of Mercy and has become a very well-known ham since gaining her license in February, 1981. Her QSL card depicts a caricature of a nun riding a broomstick. Her black habit is billowing out behind her, displaying spotted bloomers. The rig is strapped to her back, earphones are clapped over her ears, and a microphone is clutched tightly in one hand while she holds on to the broom with the other. The card was designed by Bob P29NBF, another ham from Goroka. Needless to say, that card is a prized possession of amateurs all around the world!

Bob P29NBF and his XYL bought a yacht in Cairns (Australia) towards the end of last year and sailed her up to PNG in November. During the trip, Bob maintained daily radio contact with Sister Margaret. Unfortunately, Bob is off the air at the moment, as his radio equipment was damaged in the boat.

The hottest news on the amateur bands at present is, of course, VK0HI—the Heard Island DXpedition. In spite of checking the bands every day, I have not yet managed to work Heard Island. I have heard them on 20m on a number of occasions, but of course that is out of bounds for Novices. My hopes are centered on Jim VK0JS and his XYL, Kirsti VK0YL, who finally arrived on Heard Island around February 9th after having been delayed by various problems. Jim was P29JS, and he really put P29 on the map with his activity. Several years ago, he "went finish" from PNG and took up residence on Norfolk Island, where he married Kirsti, formerly a radio officer on a Swedish ship. Jim is VK9NS and Kirsti VK9NL, but they frequently go on DXpeditions. I should be able to get a contact with Heard Island with Kirsti and Jim there.

I have had a letter from Ron ZL1AMO asking whether a CW operation in P29 would be sought after. I told him that such an operation would certainly be very much in demand and to come on over. I have been asked many times for a CW contact but always had to decline, as I don't even have a key. A real pro like Ron would therefore be a godsend!

GUAM

James T. Pogue KH2AR
68 Banyan Circle
FPO San Francisco 96630

On May 20th, 1976, super-typhoon Pamela screamed across the island of Guam with 170-mph winds. Eighteen hours later, Pamela had left in her wake one islander dead, many injured, and over 30,000 people stranded by floods from 33 inches of torrential rainfall. Over 80% of the island's buildings were destroyed and property damage exceeded $400 million.

A *New York Times* story a few days later stated that the island's communications had been "virtually destroyed." Fortunately, Guam's hams responded to the challenge and helped provide vitally-needed emergency communications. Stationed at key villages throughout the island, they assisted public officials and augmented existing public emergency services. Although the local repeater was knocked off the air due to a massive power loss, 2 meters was still the most active band during the emergency. Messages were also relayed off-island by several HF ham stations with emergency power generators.

Today, the emergency communications system on Guam is constantly striving to be ready to serve the island population. Emergency coordinator Carl Wegner KG6JKV is responsible for organizing and keeping the emergency plan current and operational. The only repeater on the island, a 25-Watt, .34/.94 machine, is located at Carl's home in Barrigada Heights, approximately 750 feet above sea level. Covering roughly 75% of the island, backup battery power can provide over 24 hours of service in the event of a power outage. Dick Takahashi AH2A has also donated a 5-kW butane generator that should soon be installed, giving virtually unlimited service life to the repeater in an emergency.

The Marianas Amateur Radio Club (MARC) has recently received permission to install equipment at the Government of Guam-maintained Emergency Operations Center (EOC). Built almost entirely underground, the EOC is virtually impervious to most natural disasters. Although some antenna problems remain to be resolved, MARC members hope to have a recently-purchased Kenwood HF rig and 2-meter gear installed before the next typhoon season.

When a typhoon is determined to be within 48 hours of possibly passing over Guam, the emergency coordinator calls the "Typhoon Net" on 2 meters. At that time, a survey of available personnel, equipment, and anticipated needs is made. With constant 6-hour updates from the Naval Oceanographic Command Center on Nimitz Hill, Guam, a constant watch is kept on the approaching storm. The hams on Saipan, approximately 100 miles north of Guam, are advised of the storm's location and forecast track via the 2-meter repeater, and hams on other more distant islands are kept posted by the Inter-Island Net that meets on 14,315 kHz.

Here on Guam, a detailed communications plan assigns a ham to the commissioner of each village—or to a group of several nearby villages—to assist him. Two meters, of course, is the standard band for operations, utilizing the .34/.94 repeater as well as .52 simplex.

For communications off-island, the normal terminus is with Hawaii. Frequencies for CW and SSB as well as RTTY have been assigned to handle health and welfare traffic, as well as government messages if asked to do so.

In order to stay proficient at emergency procedures, MARC members regularly volunteer to assist local civic groups by providing communications services for a wide variety of events. These include bike rides, walkathons, marathons, and several offshore marine events between the southern island village of Merizo and nearby Cocos Island.

In spite of all these preparations, though, the emergency communications system on Guam is not without its problems. With a large percentage of the ham population in the military, it is difficult for the Emergency Coordinator to build a steady and dependable core of operators to activate during an emergency. In the event of a typhoon, most military people are called in to their work posts for duty until the storm passes. Frequent transfers of personnel make for a constantly-fluctuating population of operators.

As has so often been the case with hams and emergency communications, the key to successful response and operations must continue to be flexibility and creativity mixed with plenty of hard work.

CANADA

Some time ago it was suggested to the Department of Communications (DOC) that there could be a number of advantages to an arrangement whereby amateurs assisted in the conduct of examinations. CARF (Canadian Amateur Radio Federation) raised the matter again with the DOC last summer. Since then, the Department has been considering the possibility of such an arrangement and the result has been a letter addressed to CARF president Don Slater VE3ID. The letter requested "detailed input" from CARF on areas pertaining to amateur participation, including minimum criteria for amateur examiners, the selection process, the maintenance of examination integrity, exam distribution, and coordination between the DOC and amateur examiners.

Some ideas for amateur participation have been discussed in recent issues of *TCA* and comment was sought from readers, but to date the response has not been exactly overwhelming. Now, however, the DOC has asked specific questions and is seeking answers from CARF and other organizations. In order to ensure that varying ideas and views are incorporated in the recommendations in the CARF brief to the DOC, comments from clubs and individuals are now urgently sought.

In other action, the DOC approved a request for commemorative prefixes for World Communications Year. Starting on World Communications Day, May 17, through July 17 (inclusive), CY may be used for VE, CI for VO, and CK for VY.

The department has also proposed new regulations covering the radio noise generated by power lines and sub-stations. The first-ever regulations are designed primarily to protect AM sound broadcasting, but obviously they would benefit amateurs as well. The proposed rules are complicated and require special measuring equipment. Amateurs who are interested in this very technical proposal may get a copy from a DOC office. Ask for Notice Delta Golf Tango Roger—021-82.

However, not all of the amendments to the Canadian amateur regulations proposed a year ago have been processed. They would permit repeater operation in the 29-MHz band, SSTV in the HF bands, 6-MHz bandwidth for ATV, and more power on 160 meters. The amendments also would allow foriegn amateurs from countries with reciprocal agreements to operate in the full two-meter band. Currently in the legal mill of the department are the 160-meter power change, deletion of mobile logging, and a provision for amateur-class operators in

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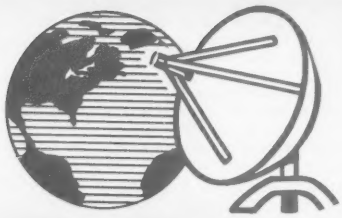

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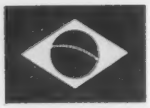

BRAZIL

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Brazil

PROCEDURES TO GET A BRAZILIAN LICENSE

If your country has a reciprocity agreement with Brazil, you have to present your original amateur license and your passport to DENTEL (Department of Communications), which has offices in all capital cities, and fill out form DNT-143. The license will be issued with a special callsign which has the letter Z after the number; for example: PY1ZXY. The license will be valid for the period of time which you will stay in Brazil or until the date your original license expires, whichever comes first.

During the valid term of the license, you do have to be a member of the Brazilian Amateur Radio League—LABRE. You may contact the League first, and they will be very kind in helping you to get your Brazilian license. Write to the League office in the state to which you are going (see box).

AWARDS

Sponsored by the Rio de Janeiro CW Group, the CWRJ Award is available to all licensed amateurs for confirmed contacts with 20 (twenty) different PY1 stations, including at least 5 (five) CWRJ members. Contacts must have been made after December 16, 1980, on any amateur band. Only two-way CW mode. No QSLs. Send GCR log of stations worked (call, date, time, band, mode, and report) and 10 IRCs for mailing expenses to CWRJ, PO Box 621, 24000 Niterio, RJ, Brazil.

Endorsements are given for each 20 new PY1 confirmed contacts which include one new CWRJ member. CWRJ members: PY1AFA, PY1AFG, PY1AJK, PY1ASI, PY1BFZ, PY1BGI, PY1BMF, PY1BOA, PY1BQQ, PY1BUG, PY1BUL, PY1BVY, PY1CBW, PY1CC, PY1CCX, PY1CCY, PY1DCG, PY1DEA, PY1DFF, PY1DGB, PY1DN, PY1DIN, PY1DJY, PY1DPG, PY1DUH, PY1EBK, PY1EWN, PY1FB, PY1HQ, PY1LG, PY1MHQ, PY1MKA, PY1RJ, PY1UET, PY1VB, PY1VLR, PY1VOY, PY1WDS, PY1WO.

The CWRJ sponsors seven more awards: the Brazilian Stations Award (BSAW), Rio de Janeiro State Cities Award (RJCAW), Geographic Brazil Award (BGAW), Worked CWRJ Associate Members Award (WAMAW), Brazil's Frontiers Award (BFAW), CWRJ YL Flowers Award (YLAW), and the Worked CWRJ Award (WRJA).

Please note that my PO Box number was printed incorrectly last month and that the correct one (12178) appears above.

GREAT BRITAIN

Amateurs in Great Britain are enjoying the recently-released *G-QRP Club Circuit Handbook*, edited by G-QRP club president, Rev. George Dobbs G3RJV. The *Handbook* has over 100 pages of QRP circuits compiled from *Sprat*, the club's newsletter. Eight years of circuits and ideas, from 1974–1982, have been included in the book. Newcomers and old-timers alike have been finding useful new circuits, as more British hams are discovering QRP. Amateurs interested in finding out more about this collection of QRP know-how should write to Alan Lake G4DVW, Middleton Cl., Nuthall, Nottingham NG16 1BX, Great Britain.

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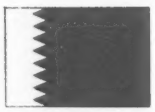

BAHRAIN

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DX CONTESTING—BAHRAIN STYLE!

Casting around for something useful to do one Friday (a Bahrain Friday equates to an American Sunday) not too long ago, a group of our erstwhile DX chasers gravitated to bandying words over 2-meter repeater A92RP. Replete no doubt with a good curry lunch, someone (he wishes to remain anonymous) voiced the thought that it would be "a very good idea" if the Association were to participate in the upcoming *CQ* WW Phone DX Contest—due to commence in a few hours time, on that Saturday morning! It was claimed that no prior contest experience was called for, but merely the ability, dedication, stamina, and willingness necessary to carry the enterprise forward to a successful conclusion. In the ensuing discussion, a consensus emerged in favor of the idea.

Suitably fired with enthusiasm and lulled no doubt by honeyed words into a false sense of security, our band of contest warriors repaired to the clubhouse; most were armed with those extra pieces of equipment individually deemed essential to the success of our communal endeavor. The capability of the already-installed club FT-101B transceiver and triband beam was to be enhanced by the addition of a KW-1000 linear amplifier—which promply resulted in cooking the coil in the 200-Watt-rated Daiwa antenna coupler! An 830S was produced with the comment that "perhaps we can manage simultaneous operation on two bands," but this of course would require a second antenna.

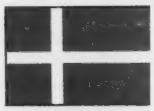
It was by this time becoming dark, so the stringing up of a trap dipole for the LF bands between our own mast and that of our landlord took place after dark. Not surprisingly, the end result when viewed in the light of the following day caused some small degree of concern—our mast had acquired a most definite southbound lean due, no doubt, to the combination of dipole and feeder weight plus over-enthusiastic late-night rigging efforts!

Whilst much of the preceding action was in progress, when the equipment was not under repair or the mast folded over for antenna work, those not otherwise gainfully occupied were conducting a radio advertising campaign, advising all interested contacts of our contest entry. Starting on 21 MHz, they moved successively to 28, 14, and 3.8, and then back to 14 in time to warm up with a few pre-contest QSOs.

Operations continued as dictated by operator availability—always a problem with our different weekend arrangements and, on this occasion, compounded by the fact that not everyone realized that it was a 48-hour contest.

How did we do? Results were reasonable: over 1050 QSOs with 60 countries spread over 5 bands, thanks to the efforts of Sheridan (A92BE), Dhiya (A92DQ), Jon (A92F), Keith (A92P), and John (A92Z).

What did we learn? Other than the obvious and fortunately minor equipment problems, we were not terribly good log-keepers with respect to frequently entering QSO times and the bands on which they were made. Poor Keith had a terrible time attempting to transcribe the log onto the summary sheets and finally had to admit defeat. We won't appear in any listing, but did most definitely have a barrel of fun. Now with all those in-house experts, perhaps the 1983 event ought to be a lot less traumatic!



DENMARK

Henrik Jacobsen OZ6PN
Klövervaenget 9
Haldbjerg
9900 Frederikshavn
Denmark

There are about 10,000 licensed radio amateurs in Denmark, but I think that only half are active on the bands. There are four license categories and most amateurs here hold a D license which allows them to work on the VHF and UHF bands with 100 Watts. The D license requires only a simple technical test and most students pass the test.

Then we have the C license, for which the technical test is the same as for the D license, but there is also a CW test. The radio amateur with a C license can work on the HF bands, but only CW with 10 W of power. However, C-class amateurs retain D-class privileges on VHF and UHF.

The next category is the B license, which requires possession of a C license for one year or an extended technical test. In both cases, it is necessary to pass a CW test. The B license allows you to work on all the amateur bands with 100 W in all modes.

And last, we have the A license, which requires a B license for one year and allows working with 500 W (0.5 kW!) on all amateur bands and with all modes.

The CW test is given at 12 wpm.

The amateur bands in Denmark are the following:

- 3.500–3.800 MHz (3.5-3.6 MHz CW only).
- 7.000–7.100 MHz (7.0-7.01 MHz CW only).
- 14.000–14.350 MHz (14.0-14.1 MHz CW only).
- 21.000–21.450 MHz (21.0-21.15 MHz CW only).
- 28.000–29.700 MHz (28.0-28.1 MHz CW only).
- 144.000–146.000 MHz (All modes—Reg. 1 band-table).
- 432.000–438.000 MHz (All modes—Reg. 1 band-table).

Danish amateurs can also use the "new" bands (CW only): 1.830–1.850 MHz, 10.100–10.150 MHz, 18.068–18.168 MHz, and 24.890–24.990 MHz.

After receiving a special permit, we may also use the following UHF and SHF bands (all modes): 1215–1300 MHz, 2300–2450 MHz, 5650–5850 MHz, 10.0–10.5 GHz, and 24.0–24.25 GHz.

All radio amateurs can work with homemade stations or with factory toys on all amateur bands, but if one wants to work on the citizens band (27 MHz), one must buy a factory-made station (maximum, 500 mW) and the station must be approved by the Post- and Teleadministration.

Denmark is a little country with about 5 million citizens, but we have a very developed electronics industry and everywhere we look, we see radio amateurs in leading positions.

Radio amateurs are mostly popular in Danish society, but we naturally have problems with hi-fis and video recorders, but our good contacts in the electronics industry can in many cases solve our problems.

This was a little about Denmark and its radio amateurs—in my next column, I will write a little about the Danish radio amateur society, the EDR.

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73¢ for a Voltage-Transient Detector

Forget those expensive and complex insurance policies. Here's the best protection you can get—and the cheapest.

Being a doubting Thomas by nature, I have often wondered about the necessity of those antenna surge protectors as advertised in the amateur press. As you know, those surge shunts as advertised are to proect solid-state communications equipment from damage caused by voltage transients entering the antenna system. Those usually are caused by atmospheric static discharges or nearby lightning strikes—according to the ads. The purpose of this article is to show you how these gremlins can be readily detected.

I am not doubting the claims of the advertisers. As any old reader of this magazine can attest, *NO* advertiser would dare to sell anything not up to its claims in this magazine. The shyster would become the object of Mr. Green's unmentionable and merciless wrath. Period. Even in light of these facts, I continued my search for proof.

The first objective was to prove visually the existence of voltage transients. Recalling from my Novice days the fact that neon bulbs glow in the presence of high voltage, I decided to utilize this method of approach. Thus, I reasoned that a neon bulb across the coax plug—disconnected, of course—would reveal the nasty little gremlins.

Neon pilot-lamp assembly.

As you can clearly see, simplicity is the nucleus of the circuit shown in Fig. 1. The parts required are readily available at any nearby hamfest flea market. After comparing many entrepreneurs' offerings of neon pilot-lamp assemblies, I found the one in the photo for a mere twenty-five cents—used, of course (both the quarter and the pilot-lamp assembly). Needless to say, all it lacked was an NE-51 bulb. The latter was obtained for an additional quarter.

Now for connecting my coax to the assembly. A clean RCA phono jack was found at another entrepreneur's stand of irresistible bargains for another quarter. Reaching into my pocket, I came up with two dimes and only three pennies. "It's a deal!" cried the businessman. Total investment? You guessed it . . . 73¢!

After what seemed a long ride home, I headed straight for the workbench (the scene of many electronic tribulations and tests). With the smell of hot solder filling the air and a period of five quick minutes, the tester became reality.

Next, I disconnected the coax connector (via a PL-259 to an RCA-type adapter) from the rig and terminated the coax into the antenna-voltage-transients detector. Did the neon glow? No. As a matter of fact, nothing happened.

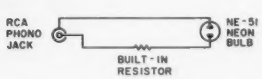

Fig. 1. One scientific circuit for detection of antenna voltage transients.

However, a few nights later while chasing some rare DX on 15 CW, a usually unwelcomed sound of keyrashing!+#%!!! noise filled the headphones! Ah, an approaching thunderstorm! Quickly! Disconnect the coax from the rig! Terminate into the 73¢ wonder! Eureka! There it was, flashing away before my very eyes! Success. The neon bulb was flashing its heart out as the thunderstorm approached. Success.

In the interest of a longer life here on Earth, I disconnected the coax and grounded everything. Be very careful when doing this . . . it is not my intention to send any readers to Silent Key land after building and using one of these 73¢ detectors. There is a high-voltage hazard present, so use your common sense and disconnect as the neon gets brighter. Also, keep the bulb cover on the assembly in case the neon bulb should break. And be sure to check for a built-in resistor in your neon pilot-lamp assembly—otherwise your NE-51 will fire its last and first time forever. Good luck and good viewing—but be careful. And yes, the ads are correct; those gremlins do indeed exist. ■

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Build the Armchair Satellite Tracker

Simple and cheap, this setup will follow OSCAR around like a dog. Put it together, lean back, and let this control system do the work for you.

Editor's Note: This ingenious tracking system can be used for satellites like UoSAT and Russian "RS" amateur birds as well as the ever popular OSCAR 8.

This article describes a fully-automatic system for tracking satellites in low, near-circular orbits such as that of OSCAR 8. The system requires as little as one rotator and a very simple rotator-control unit. Normally, two rotators will be desired, but they are not necessary to achieve fully-automatic tracking with fairly good accuracy. This system eliminates problems associated with conventional antenna-pointing systems such as high cost, complexity, and large tracking errors.

Photo A. The completed system. The tilt axis is positioned for a near-horizon satellite pass. This position may also be used for terrestrial operations using the elevation rotator as a conventional azimuth rotator.

Conventional systems are based on a system of azimuth and elevation settings. Some are computer-controlled and some use a computer-generated chart with manual adjustment of the controls of the two rotators. One system uses a single azimuth rotator with the antenna pointed about 30 degrees above the horizon. Pointing errors reach as much as 60 degrees with this system.

There is one reason common to all of these systems that makes for complexity, high cost, or marginal results: They all are based on a reference system which is parallel and perpendicular to the surface of the Earth while the satellite's orbital plane is normal to some other reference system. Conventional antenna-

pointing systems are always bucking this natural motion of the satellite. My system attempts to align the reference plane of the antenna rotator with the reference plane of the satellite. It is not perfect; it is not designed for the purist who has access to megabyte computers and megabuck wallets. It is designed for the amateur who is a casual operator but desires some sophistication and moderately good accuracy.

To obtain some idea of how my system works, let us discuss the special case of the direct overhead pass and the conventional azimuth/elevation system. Let's say the satellite is ascending, has a polar orbit, and will be above the horizon for 16 minutes. The satellite will rise in the south (bearing 180 degrees), pass directly overhead 8 minutes later, and set to the north (bearing 360 degrees) sixteen minutes after acquisition.

If we had set our elevation rotator to point at the horizon and the azimuth rotator to a bearing of 180 degrees, we could have tracked the satellite just by operating the elevation rotator only. We would start with the antenna pointing at the southern horizon, slowly rising through the vertical as the satellite passed overhead, and on to the northern horizon. In this special case, the plane of the orbit coincides with the plane described by the movement of the elevation rotator.

Next, let's examine a more common case of an other than direct overhead orbit. Imagine an orbit where the satellite reaches a maximum elevation of 60 degrees to the east of your QTH. We will start off with the conventional azimuth/elevation system by setting the azimuth rotator to a bearing of 180 degrees and the elevation rotator to point at the southern horizon. Again, the antenna will be pointing at the satellite when it rises, but if we tried to track it as in the last example, we would soon have a large tracking error. By the time the antenna reached the vertical position, the satellite would be 30 degrees away toward the east. Continuing on to the northern horizon, the pointing error would gradually decrease with the antenna again pointing at the satellite as it set to the north.

Now let's go through the last example again, only we will make an adjustment to the antenna-mounting system which will alter the results considerably. With the antenna pointing at the southern horizon, remove the azimuth rotator and mount the elevation rotator on an axle which is parallel to the surface of the Earth and aligned north-south. The elevation rotator is now free to tilt to the east or west. If we tilt the elevation rotator so that what used to be the azimuth mast is now aimed at a point 60 degrees above the eastern horizon, we will change the entire geometry of the tracking system. We lock the new axle in the 60-degree position and begin the satellite

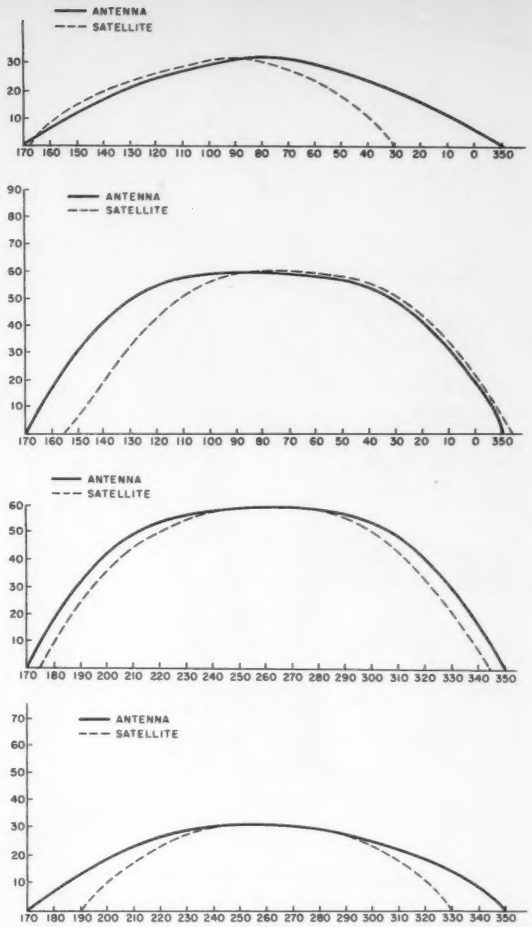

Fig. 1. Charts of relative bearings and elevations of OSCAR 8 compared to the antenna-pointing position. All satellite coordinates are for ascending orbits and a QTH latitude of 42 degrees north. Antenna-pointing positions, above, top to bottom: 30° East, 60° East, 60° West, and 30° West.

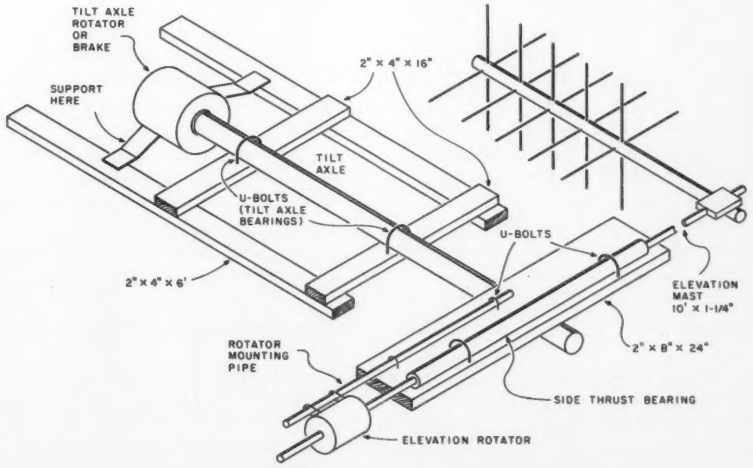

Fig. 2. Antenna/rotator assembly with antenna oriented to begin an overhead pass.

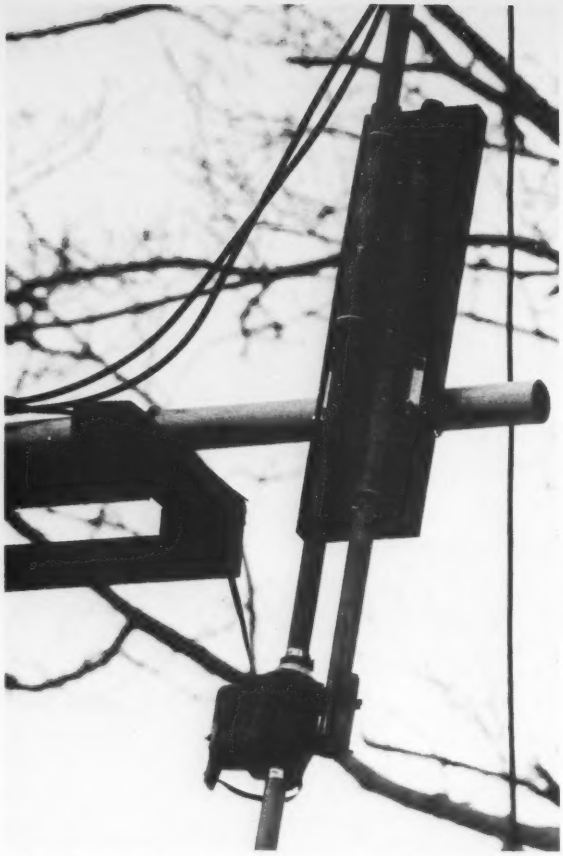

Photo B. Close-up view of the elevation rotator mounting board. Note the method of mounting. A small tab must be removed from this type of rotator in order to mount it right-side up.

pass. As the satellite rises and travels toward the midpoint of its arc, the elevation rotator is activated. Instead of moving to the vertical position, the antenna will closely follow the satellite. We have tilted the plane described by the elevation rotator so that it nearly coincides with the plane of the orbit. To the elevation rotator, the satellite appears to be making an overhead pass.

At this point, you are probably thinking that it sounds too easy and that there must be a catch. The catch is that the system is not perfect; there are some pointing errors, the magnitude of which depends on the orbit involved, the position of the satellite along the orbit, whether it is a descending or ascending pass, and if the automatic tracking unit is used. To find out just how big the errors are, I made an analysis of several typical orbits.

I selected orbits for OSCAR 8 when it reached a maximum elevation of 30 degrees and 60 degrees to the east and to the west. I also analyzed the overhead pass. I drew up charts for the first four orbits—shown in Fig. 1. (There is no chart for the overhead orbit as the antenna follows the satellite very closely and the pointing error probably does not exceed 5 degrees.) The charts are set up using conventional azimuth and elevation bearings for the two axes, azimuth along the bottom and elevation up the side. You will notice that the antenna coordinates start at 170 degrees and end at 350 degrees as opposed to a true north-south. This 10-degree difference is to compensate for the inclination of OSCAR 8's orbit and will be discussed later. The antenna coordinates have been calculated, while those for the satellites have been measured using an OSCARLOCATOR. If you use the automatic control unit, the pointing errors will generally be greater than indicated by the charts since the additional dimension of time is added. With the automatic control unit, the antenna will match the satellite at the beginning, end, and midpoint of the pass. The remainder of the time there will be some additional error. This error is greatest for overhead passes and becomes minor for passes below a maximum elevation of 60 degrees.

Mounting

The way you mount the rotators will determine the degree of success of your installation, so exercise care and do the job correctly. The angles and various motions are unusual, and if you do not think things through carefully you can get into trouble.

The most important point to keep in mind is that the system must be made so that it cannot self-destruct. In this regard, my prototype was somewhat short of being a resounding success. I was trying out the automatic control unit when I noticed that the swr seemed to be increasing on the 2-meter uplink antenna. I shut everything down and headed outside to see if I could spot a loose cable or whatever. "Whatever" turned out to be a mangled ten-element "Twist" antenna. I had gotten the control unit hooked up the wrong way and automatically rotated my antenna into the chimney on which everything is mounted. Those little TV rotators are amazingly powerful. I rebuilt everything and modified the mounting so that there is plenty of clearance for the antenna regardless of which rotator I operate in any direction. Once the rotators are set up and the antennas mounted, I suggest you move the rotator controls to a position where the antennas may be observed and try simulating several satellite passes to get the feel of everything.

The mounting I ended up with has worked well for some time now, and it was very inexpensive. I will describe it in detail so that it may be copied. The dimensions and materials are not critical and may be changed to suit your situation and junk box. I constructed the mounting first, which clamps to my chimney, but you could use any type of support such as a tower or telephone pole. Next, I built the "tilt-axis" support, a rectangular arrangement of two-by-fours used to hold the tilt-axis rotator and axle.

The axle must be long enough to allow the antenna to clear the mounting support. It is mounted parallel to the Earth on a true bearing of 350 degrees. I used a piece of 2-1/2-inch aluminum conduit for the axle and a prop-pitch motor for the tilt-axis rotator. (The motor was contributed by a friend, W1NDO/3.) Smaller tubing would work just as well, and the rotator could be eliminated. If you have access to the mounting before each satellite orbit, you could substitute a brake mechanism for the rotator. Remember that the tilt-axis rotator is not operated during any particular orbit.

I started out climbing up on the roof of my house be-

fore each pass and presetting the tilt angle. This was a little inconvenient, so I added the tilt rotator. If you do use a rotator for this function, I recommend a good one, preferably one with a brake. There will be a fair amount of stress unless you keep everything perfectly balanced.

The elevation-rotator mounting board is assembled next. I used a two-by-eight board which is secured to the tilt axle with U-bolts. This board acts as a mounting platform for the TV-type elevation rotator and holds a side-thrust bearing. This bearing is nothing more than a two-foot section of pipe which is just large enough to allow the elevation mast to pass through it without binding. I used a 1-1/4-inch mast and a pipe with a 1-3/8-inch inside diameter for the side-thrust bearing. The bearing is secured to the mounting board with two U-bolts. Be sure it is perpendicular to the tilt axle or additional tracking errors will result.

Next, insert the mast in the side-thrust bearing and attach the rotator to the mast. Bolt a short section of pipe to the bracket which is used to mount the rotator. This pipe should be parallel to the side-thrust bearing and about 3 inches away. It is fastened to the rotator mounting board with two U-bolts. The rotator should be on the opposite side of the tilt axle from the antenna to help balance the tilt axis. Be sure the rotator is not mounted upside down, as then it will turn the wrong direction. You may have to file off a small tab on some TV rotators.

Paint all wooden parts and apply a little axle grease to the bearing surfaces. The rotator assembly is ready to be mounted to your supporting structure. Since the antenna rotator assembly is fairly heavy and is not well balanced, make this attachment strong. The unbalance results from mounting the assembly near the tilt rotator so that the antenna will clear the support. You should be able to point the antenna at the support with the elevation rotator and then turn the tilt rotator through 360 degrees without the antenna being fouled anywhere. The mounting should be aligned 10 degrees west of true north. This works well for OSCAR 8.

Automatic Control Unit

The purpose of the control unit is to periodically turn the elevation rotator on and off. If the frequency and duration of the "on" pulses are just right, the antenna will move evenly across the sky from horizon to horizon in the same time it takes the satellite to make its pass. Fig. 3 is a schematic of the circuit I used to operate the elevation rotator. The values of the components will turn the rotator on every 40 seconds for a duration of 1 to 3 seconds, meaning that the rotator would be on for about 2 seconds and off for 38 seconds, then back on again. At a normal rotator speed of 1 rpm (3 degrees per second), it will take 20 minutes for the antenna to turn the necessary 180 degrees to track the satellite. By adjusting the "on" time or duration, we can adjust the effective rotation speed to correspond to the speed of the satellite.

The control is made up of two multivibrators and a relay circuit. All parts may be purchased from Radio Shack, and values are not very critical. Integrated circuit U1 is a 556 dual timer. The first timer is an astable multivibrator with a frequency of 40 seconds per cycle (.025 Hz). The other section, U1b, is a one-shot multivibrator with an adjustable cycle length. It is

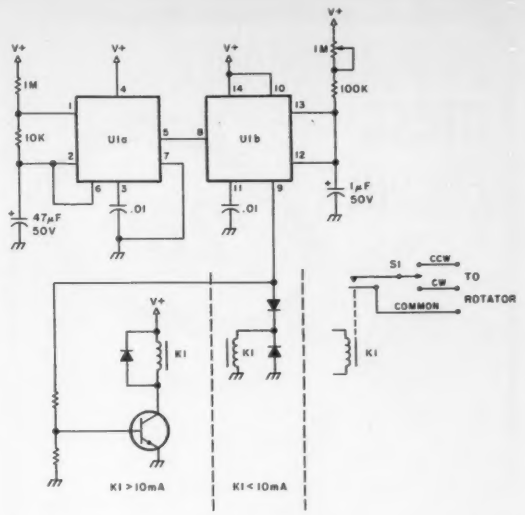

Fig. 3. Automatic control unit. The relay circuit on the left is for relays which draw over 10 mA, the one in the center for relays drawing less than 10 mA, and the circuit on the right shows the wiring of the relay contacts.

triggered by the astable multivibrator and its output operates the relay. The time constant may be varied by the 1-meg potentiometer.

Two relay circuits are shown. If your relay draws less than 10 mA, you may omit the transistor and diode D3; the IC can drive the relay directly. Be sure to use the appropriate diode to protect the transistor or the IC from high voltages which can be developed when the magnetic field in the relay collapses. The relay is wired in parallel with the rotator switch. A DPST switch is inserted in the line to select clockwise or counterclockwise rotation. The relay must be capable of handling the current and voltage across the rotator switch, so you should check this out before purchasing a relay. You may want to install another switch on the unit to operate a brake if your rotator is so equipped, or to turn the power to the rotator on and off. In my unit, the power switch was integral to the rotation switch. This on-off switch had to be paralleled along with the rotation-select switch.

Calibration of the control unit is easy. Tape a piece of paper behind the control knob for the 1-meg pot. Mark four or five settings on the paper at random. Set the control to the first mark and time how long the rotator takes to turn 180 degrees. This time, in minutes, is marked on the paper. Continue on to the other marks and do the same. You'll end up with a dial calibrated in minutes.

Operation

Operation of the system is not difficult. Using an OSCARLOCATOR or similar device, determine the maximum elevation the satellite will reach and how long it will be above the horizon. Set the tilt axle so that the elevation mast is pointing 90 degrees from the highest elevation reached by the satellite. If the satellite reaches an elevation of 60 degrees above the eastern horizon, point the elevation mast to 30 degrees above the western horizon. If the satellite reaches 40 degrees above the western horizon, point the mast 50 degrees above the eastern. Next, set the elevation to point the

antenna south for an ascending pass and north for a descending pass. If you have everything set up properly, the antenna should be horizontal. If you are using the automatic control unit, set the 1-meg control to the number of minutes the satellite will be above the horizon. Once you have acquisition of the satellite, turn on power to the control unit and everything is automatic from then on. Be sure to turn off the control unit after the pass or the antenna will continue to rotate.

If you are not using the automatic control unit, you will have to adjust the elevation rotator manually. This is really easy; just operate the elevation control from time to time keeping the signal as loud as possible. Remember, you are operating only one rotator. I found that a short burst every two or three minutes will keep your antenna fairly close to the satellite. When not using the system to track satellites, it works well for terrestrial operations. This may be accomplished by positioning the elevation mast so that it is vertical: the antenna will be horizontal and the elevation rotator will act as a conventional rotator.

My experience has shown that the automatic unit works best on orbits below 60 degrees maximum elevation. Above 60 degrees, I usually operate manually. My antenna is a ten-element Twist for 2 meters, a dipole for 10 meters, and I hope to add a small helical for 70 cm. I have had no problems with all of these antennas on my mounting. I have found that operating through OSCAR has been a real pleasure since installing my system. ■

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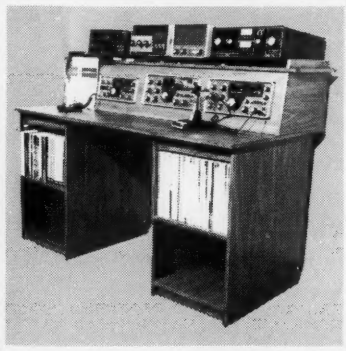

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XR8038CP (EXAR)	PRECISION WAVEFORM GENERATOR I.C. PRODUCES SINE, SQUARE, TRIANGLE, SAWTOOTH, OR PULSE WAVEFORMS WITH MINIMUM EXTERNAL COMPONENTS. FROM .001 Hz TO 1 MHz. FOR PRECISION PLL, TEST INSTRUMENTS, SWEEP AND FM GENERATION.	$3.75
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SOCIAL EVENTS

DAYTON OH
APR 29-MAY 1

The first International VHF/UHF Conference will be held from April 29-May 1, 1983, as part of the Dayton Hamvention, Dayton OH. There will be technical talks and forums with recognized experts, noise-figure and antenna-gain measuring contests, and a hospitality suite get-together with refreshments. For further information, or to advise us of participation in the noise-figure and antenna contests, please contact Jim Stitt WA8ONQ, 311 N. Marshall Road, Middletown OH 45042, or phone (513)-475-4444 (business) or (513)-863-0820 (home).

DAYTON OH
APR 30-MAY 1

The Dayton Amateur Radio Association, Inc., will sponsor the Dayton Hamvention on April 30-May 1, 1983, at the Hara Arena and Exhibition Center, Dayton OH. Admission is $7.00 in advance and $9.00 at the door (valid for all 3 days). Flea-market space is $15.00 in advance and $16.00 at the door. Other features will include forums, new products, exhibits, women's activities, awards, and special group meetings. For special motel rates and reservations, write to Hamvention Housing, 1406 Third National Building, Dayton OH 45402 (no reservations will be accepted by telephone). For other information, write Box 44, Dayton OH 45401, or phone (513)-849-1720. Make checks payable to Dayton Hamvention, Box 2205, Dayton OH 45401.

GREENVILLE SC
APR 30-MAY 1

The Blue Ridge Amateur Radio Society will hold the Greenville Hamfest on Saturday and Sunday, April 30-May 1, 1983, at the American Legion Fairgrounds, White Horse Road, ½ mile north of I-85, Greenville SC. Admission will be $3.00. For advance sales, write Mrs. Sue Chism, Rt. 6, 203 Lanewood Drive, Greenville SC 29607. Talk-in on 146.01/.61 and 223.46/224.06. For further information, write Phil Mullins WD4KTG, Hamfest Chairman, PO Box 99, Simpsonville SC 29681.

SACRAMENTO CA
MAY 1

The North Hills Radio Club will sponsor its 11th annual Sacramento Valley Amateur Radio Hamswap on May 1, 1983, from 9:00 am to 3:00 pm, at the Placer County Fairgrounds, Roseville CA. Admission is free. Tables will be $6.00 to $8.00 and tailgate sites will be $5.00. Talk-in on 144.59/145.19 (K6IS repeater). For further information, contact Doug Long KB6ZR, 8810 Swallow Way, Fair Oaks CA 95628, or phone (916) 961-0728.

CENTRALIA IL
MAY 1

The Centralia Wireless Association, Inc., will hold its annual hamfest on Sunday, May 1, 1983, at the Kaskaskia College Gymnasium, 3 miles northwest of Centralia IL. Admission to the hamfest is free and there will be no charge for the flea-market and exhibit space (a limited number of tables will be issued on a first-come, first-served basis). Doors will open at 7:00 am for flea-market and exhibit setups. Food and refreshments will be available, as well as plenty of free parking. Talk-in on 147.27/.87 and 146.52. For further information, phone Bud King WB9QEG at (618)-532-6606, Lou Hodges W9IL at (618)-533-4724, or write CWA, Inc., PO Box 1166, Centralia IL 62801.

SANDWICH IL
MAY 1

The Kishwaukee Radio Club will hold a hamfest swap and shop on Sunday, May 1, 1983, at the Sandwich Fairgrounds, Sandwich IL. Advance tickets are $2.50 and tables are $3.00 each. Overnight camping (no hookups) will be available. Talk-in on 146.52 and .13/.73. For more information, contact Howard Newquist WA9TXW, PO Box 349, Sycamore IL 60178.

MELVILLE LI NY
MAY 1

The Suffolk County Radio Club All-Indoor Flea Market will be held on Sunday, May 1, 1983, from 8:00 am to 3:00 pm, at Republic Lodge No. 1987, 585 Breadhollow Road (Route 110), Melville LI NY. General admission is $2.00; children under 12 and wives will be admitted free. Sellers' tables are $7.00 (which includes one admission). There will be refreshments and free parking. Talk-in on 144.61/145.21 and 146.52. For additional information, contact Richard Tygar AC2P evenings at (516)-643-5956.

PUTNAM CT
MAY 1

The Eastern Connecticut Amateur Radio Association will hold its 9th annual radio and computer flea market on Sunday, May 1, 1983, from 9:00 am to 2:00 pm, rain or shine, at the Elks Lodge, Putnam CT (just off exit 96 of Route 52). Tables are $5.00 in advance or $7.00 at the door. Electricity, food, and beverages will be available. Talk-in on 147.225 (K1MUJ repeater). For reservations or additional information, write Don Amirault K1APE, 66 Labonte Road, Box 310, RR #1, Thompson CT 06277, or phone (203)-923-2727.

PARAMUS NJ
MAY 1

The Bergen ARA will hold a Ham Swap 'n' Sell on May 1, 1983, from 8:00 am to 4:00 pm, at Bergen Community College, 400 Paramus Road, Paramus NJ. Admission for sellers is $3.00; buyers will be admitted free. There will be thousands of spaces but tailgating only. Sellers must bring their own tables. Talk-in on .79/.19 and .52. For more information, contact Jim Greer KK2U, 444 Berkshire Road, Ridgewood NJ 07450, or phone (201)-445-2855.

DULUTH MN
MAY 7

The Arrowhead Radio Amateur Club will hold its annual swapfest on Saturday, May 7, 1983, from 10:00 am to 3:00 pm, at the Holiday Inn, 207 West Superior Street, downtown Duluth MN. Admission will be $2.50 in advance or $3.00 at the door. Tables (4-foot) are $3.50 in advance or $4.00 at the door. There will be plenty of food, free parking in the ramp, and an enclosed shopping mall for the XYLs. Talk-in on .34/.94. For advanced reservations, room discount rates, or more information, send an SASE to Jerry Frederick N0BNG, 1127 104th Avenue West, Duluth MN 55808.

CEDARBURG WI
MAY 7

The Ozaukee Radio Club will sponsor its 5th annual swapfest on Saturday, May 7, 1983, from 8:00 am to 1:00 pm, at the Circle B Recreation Center, Highway 60, Cedarburg WI (located 20 miles north of Milwaukee). Admission is $2.00 in advance and $3.00 at the door. All 8-foot tables are $3.00. Sellers will be admitted at 7:00 am for table setups. Food and refreshments will be available. For tickets, tables, maps, or more information, send an SASE to 1983 Ozaukee Radio Club Swapfest, PO Box 13, Port Washington WI 53074.

NEENAH WI
MAY 7

The 3F ARC Swapfest will be held on May 7, 1983, from 8:00 am to 3:00 pm, at the Neenah Labor Temple, Neenah WI. Tables (4-foot) are $1.50 in advance and $2.00 at the door. Talk-in on 144.61/145.21. For advance registration, contact Mark Michel W9OP, 339 Naymut Street, Menasha WI 54952.

BREWSTER NY
MAY 7

The Putnam Emergency Amateur Repeater League (PEARL) will hold its 2nd annual indoor hamfest on Saturday, May 7, 1983, from 9:00 am to 4:00 pm, at the JFK Elementary School, Foggintown Road (off Farm-to-Market Road, off Route 312), Brewster NY. General admission is $1.00 and exhibitors' admission is $4.00. Talk-in on 144.535/145.135 and .52. For advance table registration and further information, contact Frank Konecnik WB2PTP, RD 1, 244 C, Carmel NY 10512.

DEERFIELD NH
MAY 7

The Hosstraders will hold their tenth annual Tailgate Swapfest on Saturday, May 7, 1983, from sunrise to sunset, at the Deerfield NH Fairgrounds. Admission is $1.00 for all, including tailgaters and commercial dealers. For a nominal fee, there will be Friday-night camping for self-contained rigs. No one will be admitted before 4:00 pm Friday. Profits will benefit the Boston Burn Unit of the Shriners' Hospital. Last year's donation was $2,622.75. For further information or a map, send an SASE to Norm WA1IVB, RFD Box 57, West Baldwin ME 04091; Joe K1RQG, Star Route, Box 57, Bucksport ME 04416; or Bob W1GWU, North Walton Road, Seabrook NH 03874.

BATON ROUGE LA
MAY 7-8

The Baton Rouge Amateur Radio Club will hold its annual hamfest on Saturday and Sunday, May 7-8, 1983, at Catholic High School, 855 Hearthstone Drive, Baton Rouge LA. There will be forums, and activities for the non-ham wives and children. Talk-in on .19/.79 and .52. For further information, write BRARC, PO Box 4004, Baton Rouge LA 70821.

CADILLAC MI
MAY 14

The Wexaukee Amateur Radio Association will hold its 23rd annual Swap Shop & Eyeball QSO on Saturday, May 14, 1983, from 8:00 am to 2:30 pm, in the Wexford Civic Arena, US 131 North, Cadillac MI. Transportation will be available for anyone flying in and there is camping in the area. Talk-in on 146.37/.97 (WA8SUE). For further information, please write to Wexaukee Amateur Radio Association, PO Box 163, Cadillac MI 49601.

YAKIMA WA
MAY 14-15

The Yakima Amateur Radio Club (W7AQ) will hold the Central Washington State hamfest on May 14-15, 1983, at the Hobby Building at the Central Washington State Fairgrounds, Yakima WA. On Saturday, the hours will be 9:00 am to 5:00 pm with lunch available; on Sunday, 8:00 am to 2:00 pm with breakfast and lunch available. Registration is $4.00 in advance and $5.00 at the door. Activities include regional dealers' displays and a free swap and shop with plenty of tables. Talk-in on 146.01/.61. For pre-registration, contact Dan Haughton, PO Box 9211, Yakima WA 98909.

WAGONER OK
MAY 14-15

The Broken Arrow Amateur Radio Club will hold their annual swapfest on Saturday and Sunday, May 14-15, 1983, at the Western Hills Lodge in Sequoyah Park, located 6 miles east of Wagoner OK (off highway 51). The hours on Saturday will be 9:00 am to 5:00 pm and on Sunday, 9:00 am to noon. Admission at the door is $3.00 for both days or $2.50, if pre-registered. Swap tables are available at the door for $10.00 for both days or $7.00, if pre-registered. There will be dealer and non-dealer displays and many family-fun things to do at the lodge. A cook-out dinner will be served on the lakeshore Saturday night. For more information and pre-registration forms, contact Vic Yingst KD5KI at the BAARC, PO Box 552, Broken Arrow OK 74012.

WABASH IN
MAY 15

The Wabash County Amateur Radio Club will hold its 15th annual hamfest on Sunday, May 15, 1983, from 5:00 am to 3:00 pm, at the 4-H Fairgrounds, Wabash IN. Admission is $2.50 in advance and $3.00 at the door. There will be a large flea market, a dealers' display inside, and free overnight camping. Talk-in on 147.63/.03 or 146.52. For more information, send an SASE to Dave Spangler N9ADO, 45 Grant Street, Wabash IN 46992.

EASTON MD
MAY 15

The ninth annual Easton Amateur Radio Hamfest will be held on May 15, 1983, rain or shine, from 8:00 am to 4:00 pm, in the Easton Senior High School Cafetorium, Route 50 at mile marker 66, just south of Easton MD. Donations are $2.00, with an additional $4.00 for tables or tailgaters. Talk-in on 146.445/147.045 and .52. For more information, write Van Herridge WB3HGQ, Box J, St. Michaels MD 21663 or Easton Amateur Radio Society, Inc., Box 781, Easton MD 21601.

ARVA ONT CAN
MAY 15

The annual Southern Ontario Repeater Team Amateur Radio Flea Market will be held on Sunday, May 15, 1983, from 9:00 am to 2:00 pm, at Medway High School, Medway Road (just west of Highway 4), Arva, Ontario. Admission is $2.00 per person. For sellers, indoor or outdoor permits are $1.00 and indoor tables are $2.00 each. Sellers

only will be admitted at 8:00 am; they are required to purchase an admission ticket. For table reservations, write SORT, Inc., PO Box 73, Hyde Park ONT N0M 1Z0, or call Dave Toth VE3GYQ at (519)-473-1643.

EVANSVILLE IN
MAY 15

The Tristate Amateur Radio Society (TARS) will hold their annual hamfest on Sunday, May 15, 1983, beginning at 6:00 am CDT, at the Vanderburgh County 4-H Center, Evansville IN. Admission is $2.00. It will be indoors (air-conditioned) and tables will be available. There will also be an outdoor flea market. Talk-in on 147.75/.15 and 146.19/.79. For additional information and table reservations, contact Hal Wilson WB9FNN, RR #8, Box 427B, Evansville IN 47711.

WRIGHTSTOWN PA
MAY 15

The Warminster Amateur Radio Club will hold its annual hamfest on Sunday, May 15, 1983, from 7:00 am to 2:00 pm, at the Middletown Grange Fairgrounds, Penns Park Road, Wrightstown PA, near Philadelphia. Admission is $3.00 per ham with an additional $2.00 for each 8-foot seller's space. There will be inside spaces but no power will be available. If pre-registered before May 1, 1983, the admission fee will be $1.00 less. Refreshments will be available. Talk-in on 147.69/.09 and 146.52. For more information, contact WARC, Box 113, Warminster PA 18974, or phone Frank AK3O at (215)-968-3133 after 2300 UTC.

KNOXVILLE IL
MAY 15

The Knox County Amateur Radio Club will hold their ARRL-approved 1983 hamfest on May 15, 1983, just off I-74 at Knoxville IL. Tickets are $2.00 in advance and $3.00 at the gate. Camping will be available. For more information or tickets, contact Timothy S. Smith KA9LXB, 229 South Main Street, Monmouth IL 61462, or Keith Watson WB9KHL, 119 South Cherry Street, Galesburg IL 61401.

ATHENS OH
MAY 15

The Athens County ARA will hold their annual hamfest on Sunday, May 15, 1983, from 8:00 am to 4:00 pm, at the Athens City Recreation Center, US 33 and 50. Setup begins at 7:00 am. Tickets are $1.00 in advance and $2.00 at the gate. There will be acres of outside, paved flea-market area at $2.00 per space. Indoor flea-market space is $3.00 and is available on a first-come, first-served basis. There will be food, free parking, and nearby restaurants, recreation area, and the Athens Mall. Talk-in on 146.34/.94. For more information or tickets, write ACARA, PO Box 72, Athens OH 45701, or phone Joe WB8DOD at (614)-797-4874.

ROCHESTER NY
MAY 20-21

The Rochester Hamfest, in conjunction with the ARRL New York State and Atlantic Division Conventions, will be held on May 20-21, 1983, at the Marriott Thruway Hotel and the Monroe County Fairgrounds. Tickets are $4.00 in advance and $5.00 at the gate. Flea-market tickets are $2.00 per space. The banquet will be held at 6:30 pm on Friday and be followed by the annual Funfest at 8:00 pm. The flea market will open at 6:00 am on Saturday; the commercial exhibits, at 8:30 am. The hamfest will close at 6:00 pm. There will be FCC exams given at the Rochester Hamfest for those who have sent Form 610 to FCC, 1307 Federal Building, 111 W. Huron Street, Buffalo NY 14202, by May 1st. A ladies' program will be available. Talk-in on 146.28/.88 and 144.51/145.11. For advance tickets, contact K2MP, 737 Latta Road, Rochester NY 14612. For more information, write Rochester Hamfest, 300 White Spruce Boulevard, Rochester NY 14623.

ROGERS AR
MAY 21

The Northwest Arkansas Amateur Radio Club, Inc., will hold its 3rd annual Hamfest/Swapmeet on Saturday, May 21, 1983, from 8:00 am to 4:00 pm, at the Rogers Youth Center, 315 West Olive Street, Rogers AR. General admission is free. The fee for commercial exhibitors and flea market space is $2.00 on a first-come, first-serve basis. Doors will open at 6:00 am for setups. Free parking will be available and there will be a snack bar on the premises. Talk-in on 146.16/.76 and 146.52. For more information, write Mary Webb KA5HEV, PO Box 338, Prairie Grove AR 72753.

COLUMBIA MO
MAY 21

The 8th annual Columbia Hamfest will be held on Saturday, May 21, 1983, at the Columbia Ramada Inn. Admission to the Convention Center is $3.00 at the door or $2.50 in advance. A large, hard-surfaced parking area near the Convention Center will be provided for tailgaters; reserved tailgating space is $2.00, or $1.00 as you enter. There will be a banquet on Friday night, May 20th, at the Ramada Inn with Joel P. Kleinman N1BKE as keynote speaker. Tickets are $12.00 each and may be purchased in advance only. Other features include commercial exhibits, free forums, and amateur organization meetings. Talk-in on 146.16/.76. For more information, tickets, or Ramada reservations, write Columbia Hamfest '83, PO Box 283, Columbia MO 65205.

HARTWELL GA
MAY 21-22

The Anderson, Hartwell, and Toccoa Amateur Radio Clubs will hold the 5th annual Lake Hartwell Hamfest on May 21-22, 1983, at the Lake Hartwell Group Camp, located on Highway 29, 4 miles north of Hartwell GA. There will be free admissions, camping, and flea-market space. Activities include a left-footed CW contest and games. Fishing, swimming, and camping (campgrounds open at 6:00 pm on Friday) are available on the site. Talk-in on 146.19/.79, 147.93/.33, and 146.895/.295. For further information, contact Ray Pettit WB4ZLG, Rt. #1, Dooley Drive, Toccoa GA 30577.

KENNEWICK WA
MAY 21-22

The Tri-City Hamfest Council will hold its 4th annual hamfest on May 21-22, 1983, starting at 9:00 am, at the Benton-Franklin Fairgrounds, Kennewick WA. Admission is $3.00 in advance and $4.00 at the door, and children under 12 will be admitted free. There will be vendors, swap tables, and a bunny hunt on Sunday morning. Camping and RV space will be available at the site for $6.00. For reservations or more information, write Tri-City Hamfest Council, PO Box 1181, Richland WA 99352, or phone (509)-967-2358 or (509)-586-9375.

PITTSBURGH PA
MAY 22

The 29th annual Breeze Shooters Hamfest will be held on Sunday, May 22, 1983, from 9:00 am to 5:00 pm, at the White Swan Amusement Park, Rte. 60 (Parkway West), near the Greater Pittsburgh International Airport, Pittsburgh PA. Registration is $2.00 or three for $5.00. There will be a free flea market and a family amusement park. Sheltered tables for vendors are available by advance registration only. Talk-in on 146.28/.88 or 29.0. For further information, contact Don Myslewski K3CHD, 359 McMahon Road, North Huntingdon PA 15642, or phone (412)-863-0570.

DELOIT IA
MAY 22

The Denison Repeater Association will hold its annual flea market on Sunday, May 22, 1983, from 8:30 am to 4:00 pm, in Deloit IA. General admission is $1.50 in advance or $2.00 at the door. Sellers' tables are $2.00 in advance or $3.00 at the door. There will be tailgating, if weather permits. Talk-in on 147.69/.09 and 146.52. For more information, write Gene Mitchell NØDQS, Highway 39, Deloit IA 51441, or call (712)-263-4782.

FREMONT OH
MAY 22

The Fremont, Ohio, Radio Club, in cooperation with the Ottawa County Radio Club, will hold their 6th annual hamfest on May 22, 1983, beginning at 8:00 am, at the fairgrounds in Fremont OH. Flea-market tickets are $2.50 in advance and $3.00 at the door. Tables are $3.00 per 8 feet. Dealers may set up at 7:00 am. Talk-in on .31/.91 and .52. For tickets and table reservations, send an SASE to John Dickey W8CDR, 545 N. Jackson Street, Fremont OH 43420, or call (419)-332-8066.

MUNCIE IN
MAY 22

The fourth annual MAARC Hamfest will be held on Sunday, May 22, 1983, from 8:00 am to 3:00 pm, in the Memorial Building located on the grounds of the Delaware County Fairgrounds. Tickets are $2.00 in advance and $3.00 at the door, and flea-market tables are $5.00 each on a first-come basis. Two new features are computer displays and the first annual Middletown USA QSO party which will be run during this weekend. The MAARC club station will be in operation from the hamfest site. Electrical hookups and security will be provided during the entire show in a clean and fully enclosed building. Food and free parking will be available. Talk-in on 146.13/.73, 146.52, and 223.10/224.70. For additional information, contact Craig Graham WD9EHF, RR 12, Box 86, Muncie IN 47302.

KNOXVILLE TN
MAY 28-29

The Radio Amateur Club of Knox County will hold its 17th annual hamfest on May 28-29, 1983, at the Kerbella Temple Auditorium, just east of US 441 at the Tennessee River behind the Vol Inn Motel. On Saturday, the hours will be 9:00 am to 5:00 pm and on Sunday, 10:00 am to 4:00 pm. Admission is $2.00 in advance and $3.00 at the door. There will be radio and computer forums, dealers, indoor and tailgate flea markets, and free parking. Talk-in on 147.90/.30. For tickets, dealer, or flea-market information, contact Mark Nelson AJ2X, 4317 Foley Drive, Knoxville TN 37918, or phone (615)-687-9656.

WEST FRIENDSHIP MD
MAY 29

The Maryland FM Association will hold its annual hamfest on Sunday, May 29, 1983, from 8:00 am to 4:00 pm, at the

HAM HELP

Is anybody out there willing to donate printed QSL cards? Surely somebody prints them up who could donate a batch.

Gary Mitchell KH8AC
c/o Box 1536
Hilo HI 96720

I am looking for information on RTTY interfacing for the Texas Instruments TI-99/4A home computer.

Paul McDonald
PO Box 7068
Nashua NH 03060

I need service information and schematics for the Bearcat 220 scanner. I will pay copying and mailing costs.

Scott Raigner N7BNP
626 NE Floral Pl.
Portland OR 97232

Wanted: Technical Material Corp. PS-4A low-voltage power supply (military no. PP-2765A:URA-36) for use with the PAL-1K(A) linear amplifier.

Michael Pellock NA6J
4955 School House Road
Catheys Valley CA 95306

I would like to find the schematic and maintenance manual for the Ligna-Sweep model C-P, made by Kay Electronics of Pine Brook NJ. I will pay all costs.

Stas J. Andrzejewski W6UCM
7970 Orchid Dr.
Beuna Park CA 90620

Can anyone provide me with detailed information for properly connecting a TVT 6-5/8 (a construction project from *Cheap Video Cookbook* by Don Lancaster) to a VIC-20 computer?

Joe Demke W7KCF
R4-100
Hillsboro OR 97123

I am desperately looking for a schematic and technical manual for a Pride KW-ONE 80-10 meter linear amplifier. I will pay a reasonable fee for the information.

Mark Macklenar WB8EHE
23563 W. Walbridge Rd.
Curtice OH 43412

I have an Aerotron 700 FM base station and I need a schematic for it. I would also like to hear from someone who has converted this rig to 10-meter FM.

Hoyt Duff KB4OQ
2209 New Bern Lane
Virginia Beach VA 23451

I am looking for manuals or schematics for the Hickock model 1805A oscilloscope, Polarad model DU2A TSA-W spectrum analyzer, Ampex model VR 7000 video tape recorder #70, Singer TML 4/120 telemetering indicator, Erie model 400 counter, Beckman model 7360-20 counter, and TEK 535-S4 oscilloscope.

Jim Babb WA0DBT
636 N. 8
Wakeeny KS 67672

Howard County Fairgrounds in West Friendship MD (about 30 miles west of Baltimore on I-70). Admission is a $3.00 donation, tailgating is $3.00, and inside tables are $6.00 each in advance and $10.00 each on the day of the hamfest, if available. There will be commercial displays (commercial vendors must have proper tax/license certificates available and items offered for sale must be amateur-radio related). Ample parking, food, and drink will be available. Talk-in on 146.16/.76 and 146.52. For reservations and more information, contact John Elgin WA3MNN, 5495 Apt. 2, Harpers Farm Road, Columbia MD 21044, or phone (301)-596-3741.

ST. PAUL MN
JUN 4

The North Area Repeater Association will sponsor the Amateur Fair, a swapfest and exposition, on June 4, 1983, from 6:00 am to 6:00 pm, at the Minnesota State Fairgrounds in St. Paul MN. Admission is $4.00 and children under 12, accompanied by an adult, will be admitted free. Features will include an inside flea market but space is limited and available on a first-come, first-serve basis and tables will not be provided. There will be demonstrations, exhibits, booths, an outdoor flea market, and on Friday, June 3rd, free overnight parking for self-contained campers. There will be food concessions inside and outside, and free parking will be available. Talk-in on .25/.85 or .16/.76. For more information or dealer inquiries, write Amateur Fair, PO Box 857, Hopkins MN 55343, or call (612)-420-6000.

GUELPH ONT CAN
JUN 4

The Guelph Amateur Radio Club (VE3ZM) will hold the 9th annual Central Ontario Amateur Radio Flea Market and Computerfest on Saturday, June, 4, 1983, from 8:00 am to 4:00 pm, at Regal Hall, 340 Woodlawn Road West, Guelph ONT. Admission is $2.00 and children 12 years and under will be admitted free. Vendors must pay an additional $3.00. Doors will be open to vendors only from 6:00 am and a quantity of 3′ × 8′ tables will be available for rental for $5.00 each. Features will include commercial displays, surplus dealers, computer software and hardware, indoor and outdoor displays, and a refreshment concession. Talk-in on 146.370/146.970 (VE3KSR), 147.960/147.360 (VE3ZMG), and .52/.52. For further information contact Al Krist VE3KVI at (519)-821-4337, Henry Christiansen VE3BYU at (519)-743-9022, or write VE3ZM, PO Box 1305, Guelph ONT N1H 4M9, Canada.

GRAND RAPIDS MI
JUN 4

The Independent Repeater Association will hold its annual Hamfestival on Saturday, June 4, 1983, from 8:00 am to 4:00 pm, at the Wyoming National Guard Armory, 44th Street, just east of the US-131 expressway. Admission is $3.50. Free table space will be provided to all sellers and dealer setups will be at 6:00 am. Programs will include ATV, satellites, QRP, DX, a CW rx contest, computers, technical upgrade course, MARS, and a shack-photo contest. Talk-in on 147.165/147.765. For advance table reservations or for more information, call John Knoper KC8KK at (616)-534-5501, or write IRA, 562 92nd Street, SE, Byron Center MI 49315.

MANASSAS VA
JUN 5

The Ole Virginia Hams ARC, Inc., will hold the ninth annual Manassas Hamfest on Sunday, June 5, 1983, beginning at 8:00 am, at the Prince William County Fairgrounds, VA Route 234, ½ mile south of Manassas VA. General admission is $4.00 per person (children under 12 will be admitted free) and there will be no advance sales. Activities will include 25 acres of tailgating (setups at 7:00 am), indoor commercial exhibits, breakfast and lunch menus, a YL program, and CW proficiency awards. Talk-in on 146.37/.97 (Manassas repeater) and 146.52. For more information, contact Bob Kelly KA4NES, General Chairman, Manassas Hamfest, c/o Ole Virginia Hams ARC, Inc., PO Box 1255, Manassas VA 22110, or phone (703)-361-9468.

HUMBOLDT TN
JUN 5

The Humboldt Amateur Radio Club will hold its annual hamfest on Sunday, June 5, 1983, from 8:00 am to 4:00 pm, at Bailey Park in Humboldt TN. Admission is $2.00. There will be a flea market, ladies' activities, lunches, refreshments, and RV parking. Talk-in on 146.37/.97. For more information, contact Ed Holmes W4IGW, 501 N. 18th Avenue, Humboldt TN 38343.

CHELSEA MI
JUN 5

The Chelsea Swap and Shop will be held on Sunday, June 5, 1983, at the Chelsea Fairgrounds, Chelsea MI. Gates will open for sellers at 5:00 am and for the public from 8:00 am until 2:00 pm. Donation is $2.50 in advance or $3.00 at the gate. Children under 12 and non-ham spouses will be admitted free. Table space is $6.00 per 8 feet and trunk sales are $2.00 per space. There will be plenty of parking (including for the handicapped) and there are campgrounds available in the area. Talk-in on 146.520 and 147.855. For more information, write William Altenberndt, 3132 Timberline, Jackson MI 49201.

TERRE HAUTE IN
JUN 5

The 37th annual Wabash Valley Amateur Radio Hamfest will be held on June 5, 1983, at the Vigo County Fairgrounds on US-41, ½ mile south of I-70. Advance registration is $2.00 or 3 for $5.00, or $3.00 at the gate (children under 12 will be admitted free). A covered, 12 × 12, flea-market space is $3.00; outdoor flea-market space is free. Some ac and tables will be available on a first-come basis. There will be overnight camping, food and refreshments, and a giant shopping mall nearby. Forums will include computer and ARES. For tickets and detailed information, send an SASE to WVARA Hamfest, PO Box 81, Terre Haute IN 47808.

COEUR D'ALENE ID
JUN 11

The Kootenai Amateur Radio Society will hold their Hamfest '83 on Saturday, June 11, 1983, from 8:00 am to 4:00 pm, at the North Idaho Fairgrounds, Coeur d'Alene ID. There will be free swap tables, a large RV parking area, and food available. Talk-in on 146.38/.98 or 146.52. For further information, contact Vladimir J. Kalina, South 1555 Signal Point Road, Post Falls ID 83854.

BOWLING GREEN KY
JUN 11

The Kentucky Colonels Amateur Radio Club, Inc., will hold the 1st annual Bowling Green Swapfest on June 11, 1983, from 8:00 am to 4:00 pm, at the Jaycee Pavilion, Morgantown Road (off US 231), Bowling Green KY. Donations are $2.50 in advance and $3.00 at the door. Indoor, air-conditioned vendor space is $1.00; outside vendor space will be available and all setups begin at 7:30 am. Proceeds will go for emergency communications equipment. There will be plenty of free parking and concessions will be available. Talk-in on .25/.85 (KA4CLL) or 146.52. For more information or advance tickets, please send an SASE to Jack Wilson WA4SAC, 451 Skyline Tr. Park, Bowling Green KY 42101, or Ed Schwab KA4REF, 1546½ Chestnut Street, Bowling Green KY 42101.

DEAL NJ
JUN 12

The Jersey Shore Chaverim Amateur Radio Club will hold the Jersey Shore Hamfest and Electronic Flea Market on June 12, 1983, from 9:00 am to 3:30 pm, at the Jewish Community Center, 100 Grand Avenue, Deal NJ. Admission is $3.00 per person (children under 12 and XYLs will be admitted free). Indoor space is $5.00 for an 8-foot table and outdoor tailgating is $2.50 per space. Refreshments will be available. Talk-in on 147.045 + .6 and 146.52 simplex. For space reservations, send an SASE and check (payable) to Jersey Shore Hamfest, PO Box 192, West Long Branch NJ 07764 by May 15, 1983.

CORTLAND NY
JUN 18

The Skyline Amateur Radio Club (SARC) will hold their hamfest on June 18, 1983, from 9:00 am to 5:00 pm, rain or shine, at the Cortland County Fairgrounds, I-81, Exit 12, Cortland NY. There will be indoor and outside flea markets. Talk-in on .52. For additional information, write Robert H. Partigianoni, Advertising Chairman, Skyline Amateur Radio Club, PO Box 537, Tully NY 13159, or phone (315)-696-8476.

WILKES-BARRE PA
JUN 19

The Murgas Amateur Radio Club K3YTL will sponsor the annual Wilkes-Barre PA Hamfest on Sunday, June 19, 1983, beginning at 8:00 am, rain or shine, at the Kingston Armory, Market Street, Kingston PA. Donations are $3.00 (children under 12 and XYLs will be admitted free) with tailgating $1.00 extra per space. Doors will open at 6:00 am for setups only. There will be plenty of food and free parking. Talk-in on 146.61, 146.88, 224.66, and 142.52 simplex. For more information, contact Hamfest Committee, PO Box 1094, Wilkes-Barre PA 18703, or phone (717)-779-3882.

MILTON ONT CAN
JUL 9

The Burlington Amateur Radio Club, Inc., will host the ninth annual Ontario Hamfest on Saturday, July 9, 1983, at the Milton Fairgrounds. For more information, write Burlington Amateur Radio Club, Inc., PO Box 836, Burlington ONT L7R 3Y7, Canada.

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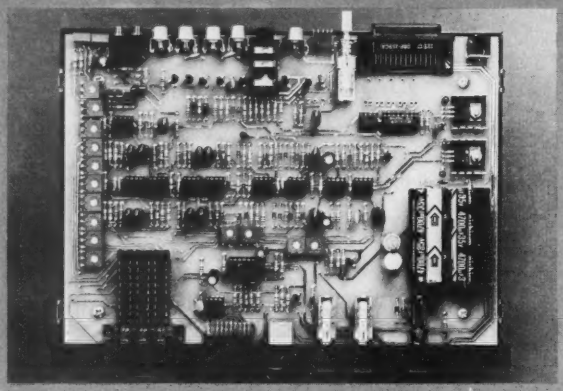

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FCC

LICENSE EXAMINATIONS

Reprinted from the *Federal Register*, the following is the text of the FCC's proposed rule which would turn license-examination responsibilities over to amateurs.

PART 0—[AMENDED]

Parts 0, 1 and 97 of the Commission's Rules are amended as follows:

1. Paragraph (a) of § 0.483 is revised to read:

§ 0.483 Applications for amateur or commercial radio operator licenses.

(a) Application for a new or upgraded amateur operator license shall be submitted to the examiners prior to the examination (See § 97.26). The examiners are required to submit the applications of persons passing their respective examinations to the Commission (for Novice Class operator licenses) or to the Volunteer-Examiner Coordinator (for all other Amateur operator licenses). All other applications for amateur radio licenses shall be submitted to the Federal Communications Commission, Gettysburg, Pennsylvania 17325. Only one copy of the application is required.

* * * * *

2. A new § 0.484 is added to read:

§ 0.484 Amateur radio operator examination points.

Generally, examinations for amateur radio operator licenses shall be administered at locations and times specified by volunteer examiners. When the FCC conducts examinations for amateur raduo operator licenses, they shall take place at locations and times designated by the FCC.

3. The heading of § 0.485 is revised to read:

§ 0.485 Commercial radio operator examinations.

* * * * *

PART 1—[AMENDED]

4. Paragraph (a) of § 1.912 is revised to read:

§ 1.912 Where applications are to be filed.

(a) Applications for any class of new or upgraded amateur operator license shall be submitted to the examiners prior to the examination. (See § 97.26) The examiners are required to submit the applications of persons passing their respective examinations to the Commission (for Novice Class operator licenses) or to the Volunteer-Examiner Coordinator (for all other Amateur operator licenses). All other applications for amateur radio licenses shall be submitted to the Federal Communications Commission, Gettysburg, Pennsylvania 17325. Only one copy of the application is required.

* * * * *

5. Paragraph (e) of § 1.925 is revised to read:

§ 1.925 Application for special temporary authorization, temporary permit, temporary operating authority, or interim amateur permit.

* * * * *

(e) Upon successful completion of an Amateur Radio Service operator examination, an applicant already licensed in the Amateur Radio Service may operate his/her amateur radio station pending issuance of his/her permanent amateur station and operator licenses by the Commission for a period of 90 days or until issuance of the permanent operator and station licenses, whichever comes first, consistent with the rights and privileges of the higher operating class for which the applicant has passed the appropriate examination(s), provided that the applicant retains the certificate(s) issued by a VEC for successful completion of the examination(s) at the station location, and provided that the applicant uses an identifier code provided by a VEC as a suffix to his/her present call sign.

* * * * *

6. Section 1.934 is revised to read:

§ 1.934 Procedure with respect to amateur radio operator license.

Each candidate for an amateur radio license which requires the applicant to pass one or more examination elements must present the examiner(s) with a properly completed FCC Form 610 prior to the examination. Upon completion of the examination, the examiner(s) will immediately grade the test papers. If the applicant is successful, the examiner(s) will forward the candidate's application to: (1) The Commission's Gettysburg, Pennsylvania facility for an application for a Novice Class operator license, or (2) a Volunteer-Examiner Coordinator (VEC) for all other classes of operator licenses. A VEC will then issue a certificate for successful completion of an amateur radio operator examination, and will forward the application to the Commission's Gettysburg, Pennsylvania facility.

PART 97—[AMENDED]

7. New § 97.26 is added to read:

§ 97.26 Examination procedure.

(a) Each examination for an amateur radio operator license shall be administered at a location and a time specified by the examiners.

(b) The examiners must be present and observing the candidate throughout the entire examination.

(c) The examiners will be responsible for the proper conduct and necessary supervision during each examination.

(d) Each candidate for an amateur radio license, which requires the applicant to pass one or more examination elements, must present the examiners with a properly completed FCC Form 610 prior to the examination.

(e) The candidate shall comply with the instructions given by the examiners. The examiners must immediately terminate the examination upon failure of the candidate to comply with the examiners' instructions.

(f) At the completion of the examination, the candidate shall return all test papers to the examiners.

8. Section 97.27 is revised to read:

§ 97.27 Examination preparation.

(a) Each Novice code test (Element 1(A)) shall be prepared by the examiner. The examiner must hold an Amateur Extra, Advanced, or General Class operator license. The test shall be such as to prove the applicant's ability to send correctly by hand and to receive correctly by ear texts in the international Morse code at the rate of five (5) words per minute. Subjects for this code test may include the twenty-six letters of the alphabet, the numerals 0–9, the period, the comma, the question mark, AR, SK, BT, and DN.

(b) The general code test and the expert's code test (Elements 1(B) and 1(C)) shall be prepared by the examiners. The test shall be such as to prove the applicant's ability to send correctly by hand and to receive correctly by ear texts in the international Morse code at not less than the prescribed speed. Subjects for these code tests may include the twenty-six letters of the alphabet, the numerals 0–9, the period, the comma, the question mark, AR, SK, BT, and DN.

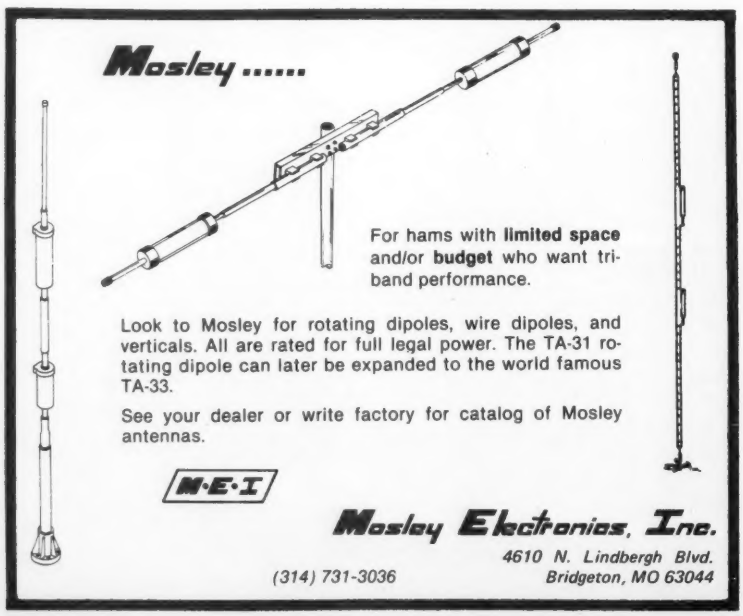
(c) Each written test for the Novice Class operator license shall be prepared by the examiner. The test shall be such as to verify the candidate's knowledge of each general subject area listed for the Element 2 test in the Commission's *Study Guide for the Amateur Radio Operator License Examinations* (PR Bulletin 1035, latest date of issue), but need not be limited to the list of questions approved by the Commission for Element 2 (PR Bulletin —, latest date of issue).

(d) Each written test, except for the Novice Class operator license, will be designed by the Federal Communications Commission (FCC). The FCC will select questions for each test from the list of questions approved by the Commission (PR Bulletin —, latest date of issue). Volunteer-Examiner Coordinator (VEC's) and Amateur radio operators may suggest questions to be included on this list by submitting them in accordance with the instructions in PR Bulletin 1035. VEC's and Amateur radio operators holding Amateur Extra Class licenses may submit questions for any written examination element. Amateur radio operators holding Advanced Class licanses may only submit questions for Element 2 and 3. Amateur radio operators holding General Class or Technician Class licenses may only submit questions for Element 2. For any given written examination element, the percentage of questions on each subject shall be specified in PR Bulletin 1035.

9. Section 97.28 is revised to read:

§ 97.28 Examination administration.

(a) Unless otherwise prescribed by the Commission, each examination for an amateur radio operator license (except the Novice Class operator license) shall be administered by three accredited volunteer examiners (see § 97.30). There will be a team chief. The team chief must hold an Amateur Extra Class operator license. The other two accredited volunteer examiners must hold Amateur Extra Class operator licenses, unless: (1) They are administering telegraphy element 1(A), in which case they may hold Amateur Extra Class, Advanced Class or General Class radio operator licenses, or (2) they are administering written examination elements 2 or 3, in which case they may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(b) Unless otherwise prescribed by the Commission, each examination for the Novice Class operator license shall be administered by one volunteer examiner. The examiner does not have to be accredited. The volunteer examiner must hold a current General, Advanced or Amateur Extra Class operator license issued by the Commission.

(c) Each team chief shall maintain a record of each examination he/she administers. This record shall be maintained in the team chief's station records for one year following the administration of the examination. This record shall be made available to the Commission upon request. The record shall include:

(1) Candidate's name and address;

(2) Candidate's amateur radio station call sign (if any);

(3) Examination location and date administered;

(4) The examination papers;

(5) The examination grades; and

(6) Names of other examiners also administering the examination.

(d) Upon completion of the examination, the examiners shall immediately grade the test papers.

(e) When the candidate does not score a passing grade on an examination element, the examiners shall so inform the candidate and return the application (see § 97.26) to the candidate.

(f) When the candidate scores a passing grade on all examination elements required for the class operator license sought (see § 97.23), the examiners shall certify to the following information on the candidate's application form (see § 97.26):

(1) Examiners' names, addresses and amateur radio station call signs;

(2) Examiners' qualifications to administer the examination (see § 97.30); *and*

(3) Examiners' signed statements that the applicant has passed the required examination elements.

(g) Within ten days of the administration of a successful examination for the Novice Class operator license, the examiner shall submit the candidate's application to: Federal Communications Commission, Gettysburg, Pennsylvania 17325.

(h) Within ten days of the administration of a successful examination for the Technician, General, Advanced, or Amateur Extra Class operator license, the examiners shall submit the candidate's application to a Volunteer—Examiner Coordinator.

10. A new § 97.29 is added to read:

§ 97.29 Examination grading.

(a) Each examination element shall be graded separately by the examiners.

(b) An applicant passes a written examination if he/she answers at least 74 percent of the questions correctly.

(c) An applicant passes a code element examination if he/she proves his/her ability to send correctly by hand and to receive correctly by ear texts in the international Morse code at not less than the prescribed speed.

11. A new § 97.30 is added to read:

§ 97.30 Volunteer examiner requirements.

(a) Each volunteer examiner administering an examination for an amateur radio operator license must be at least 18 years of age and unrelated to the candidate.

(b) Any person who owns a significant interest in, or is an employee of, any company or other entity which is engaged in the manufacture or distribution of equipment used in connection with amateur radio transmissions, or in the preparation or distribution of any publication used in preparation for obtaining amateur station operator licenses, is ineligible to be a volunteer examiner.

(c) Each volunteer examiner shall be uncompensated for his/her services.

(d) Each volunteer examiner administering an examination for the Technician, General, Advanced or Amateur Extra Class operator license must be accredited by the Volunteer-Examiner Coordinator (see Subpart I).

§ 97.31 [Reserved]

12. Section 97.31 is removed and reserved.

13. A new Subpart I is added to Part 97 to read, as follows:

Subpart I—Volunteer-Examiner Coordinators

General

Sec.

97.501 Purpose.

97.503 Definitions.

97.505 Applicability of rules.

Volunteer-Examiner Coordinator Functions

97.511 Agreement required.

97.513 Scheduling of examinations.

97.515 Coordinating volunteer examiners.

Sec.

97.517 Written examinations.

97.519 Examination procedures.

97.521 Evaluation of questions.

97.523 Identification of applicants passing examinations.

Authority: 47 U.S.C. 154(i) and 303(r).

Subpart I—Volunteer-Examiner Coordinators

General

§ 97.501 Purpose.

The rules in this subpart are designed to provide for the establishment of volunteer-examiner coordinators to coordinate the efforts of volunteer examiners in preparing and administering examinations for amateur radio operator licenses.

§ 97.503 Definitions.

For the purpose of this subpart, the following definitions are applicable:

(a) *Volunteer-examiner coordinator* (VEC). An entity which has entered into an agreement with the Federal Communications Commission to coordinate the efforts of volunteer examiners in preparing and administering examinations for amateur radio operator licenses.

(b) *Volunteer-examiner.* An amateur radio operator who prepares or administers examinations to applicants for amateur radio operator licenses (see § 97.30).

§ 97.505 Applicability of rules.

These rules apply to each entity that serves as a volunteer examiner coordinator.

Volunteer-Examiner Coordinator Functions

§ 97.511 Agreement required.

No entity may serve as a VEC until that entity has entered into a written agreement with the Federal Communications Commission to do so. The VEC must abide by the terms of that agreement.

§ 97.513 Scheduling of examination.

A VEC will coordinate the dates and times for scheduling examinations (see § 97.26) throughout the areas where communications are regulated by the Federal Communications Commission. A VEC may also coordinate the scheduling of testing opportunities at other places.

§ 97.515 Coordinating volunteer examiners.

A VEC will accredit amateur radio operators, licensed by the Federal Communications Commission, as volunteer examiners (see § 97.30). A VEC will seek to recruit a broad representation of amateur radio operators to be volunteer examiners. A VEC may not discriminate in accrediting volunteer examiners on the basis of race, sex, religion or national origin. A VEC may not refuse to accredit a volunteer on the basis of membership in an amateur radio organization. A VEC may refuse to accredit an amateur radio operator volunteering to be an examiner if:

(a) The volunteer examiner does not meet minimum statutory qualifications or minimum qualifications as prescribed by the rules;

(b) The FCC refuses to accept the voluntary and uncompensated services of the volunteer examiner;

(c) The VEC determines that the volunteer is not competent to perform the function for which he/she volunteered;

(d) The VEC determines that questions of the volunteer's integrity or honesty could compromise the examination(s); *OR*

(e) The VEC determines that no additional volunteers are needed.

§ 97.517 Written examinations.

A VEC will assemble, print and distribute written examinations designed by the FCC (see § 97.27(d)).

§ 97.519 Examination procedures.

At the completion of each examination, a VEC will collect the candidates' application forms and test results from the volunteer examiners (see § 97.28(h)). A VEC will:

(a) Make a record of the date and place of the test; the names of the volunteer examiners and their qualifications; the names of the candidates; the test results; and, related information.

(b) Screen the application for completeness and authenticity.

(c) Forward the application to: Federal Communications Commission, Licensing Division, Private Radio Bureau, Gettysburg, Pennsylvania 17325.

§ 97.521 Evaluation of questions.

A VEC will be expected to evaluate the clarity and accuracy of examination questions on the basis of experience, and to bring ambiguous or inaccurate questions to the attention of the Commission, with a recommendation on whether to revise the question or to delete the question from the Commission's list of approved questions.

§ 97.523 Identification of applicants passing examinations.

(a) A VEC will issue a certificate for successful completion of an amateur radio operator examination.

(b) The VEC issuing a certificate for successful completion of an examination will establish a unique identifier code for each testing session. The identifier code will be appended as a suffix to the licensee's call sign (see § 97.84(f)).

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extensive on-the-air testing, until now off limits to most amateurs. The following is the text of the FCC's recent ruling which permits all amateurs to use AMTOR.

PART 97—[AMENDED]

Part 97 of the Commission's Rules and Regulations, 47 CFR Part 97, is amended as follows:

In § 97.69, paragraphs (a) and (b) are revised to read as follows:

§ 97.69 Digital communications.

* * * * *

(a) The use of the digital codes specified in paragraph (b) of this section is permitted on any amateur frequency where F1 emission is permitted, subject to the following requirements:

(1) The sending speed shall not exceed the following:

(i) 300 baud on frequencies below 28 MHz;

(ii) 1200 baud on frequencies between 28 and 50 MHz;

(iii) 19.6 kilobaud on frequencies between 50 and 220 MHz;

(iv) 56 kilobaud on frequencies above 220 MHz.

(2) When type A2, F1 or F2 emissions are used, the radio or audio frequency shift (the difference between the frequency for the "mark" signal and that for the "space" signal), as appropriate, shall be less than 900 Hz.

(3) When type A2 or F2 emissions are used, the highest fundamental modulating frequency shall be less than 3000 Hz.

(b) Except as provided for in paragraph (c) of this section, only the following digital codes, as specified, may be used:

(1) The International Telegraph Alphabet Number 2 (commonly known as Baudot); provided that transmission shall consist of a single channel, five unit (start-stop) teleprinter code conforming to the International Telegraph Alphabet Number 2 with respect to all letters and numerals (including the slant sign or fraction bar); however, in the "figures" positions not utilized for numerals, special signals may be employed for the remote control of receiving printers, or for other purposes indicated in this section.

(2) The American Standard Code for Information Interchange (commonly known as ASCII); provided that the code shall conform to the American Standard Code for Information Interchange as defined in American National Standards Institute (ANSI) Standard X3.4–1968.

(3) The International Radio Consultative Committee (CCIR) Recommendation 476–2 (commonly known as AMTOR); provided that the code, baud rate and emission timing shall conform to the specifications of CCIR 476–2 (1978) Mode A or Mode B.

SATELLITES

Amateur Satellite Reference Orbits

	Date	OSCAR 8 UTC	OSCAR 8 EQX	RS-5 UTC	RS-5 EQX	RS-6 UTC	RS-6 EQX	RS-7 UTC	RS-7 EQX	RS-8 UTC	RS-8 EQX	Date
	====	========		========		========		========		========		====
May	1	0127	104	0156	240	0059	230	0141	238	0059	225	1
	2	0131	105	0151	240	0043	228	0131	237	0057	226	2
	3	0135	106	0146	240	0028	225	0122	236	0054	226	3
	4	0140	108	0140	241	0013	223	0112	235	0051	227	4
	5	0001	83	0135	241	0156	250	0102	234	0048	228	5
	6	0005	84	0130	241	0141	248	0053	234	0045	229	6
	7	0010	85	0124	241	0125	246	0043	233	0042	230	7
	8	0014	86	0119	241	0110	244	0033	232	0040	230	8
	9	0018	87	0114	242	0054	241	0024	231	0037	231	9
	10	0023	88	0108	242	0039	239	0014	230	0034	232	10
	11	0027	90	0103	242	0024	237	0004	229	0031	233	11
	12	0032	91	0058	242	0008	234	0154	258	0028	234	12
	13	0036	92	0052	242	0151	262	0144	257	0025	235	13
	14	0040	93	0047	242	0136	259	0135	256	0023	235	14
	15	0045	94	0042	243	0121	257	0125	255	0020	236	15
	16	0049	95	0036	243	0105	255	0115	255	0017	237	16
	17	0053	96	0031	243	0050	252	0106	254	0014	238	17
	18	0058	97	0026	243	0034	250	0056	253	0011	239	18
	19	0102	99	0020	243	0019	248	0046	252	0008	239	19
	20	0106	100	0015	244	0004	245	0037	251	0005	240	20
	21	0111	101	0010	244	0147	273	0027	250	0003	241	21
	22	0115	102	0004	244	0131	271	0017	249	0000	242	22
	23	0120	103	0159	274	0116	268	0008	248	0157	273	23
	24	0124	104	0153	274	0101	266	0157	277	0154	274	24
	25	0128	105	0148	275	0045	264	0147	276	0151	274	25
	26	0133	106	0143	275	0030	261	0138	276	0148	275	26
	27	0137	108	0137	275	0014	259	0128	275	0145	276	27
	28	0141	109	0132	275	0158	286	0118	274	0142	277	28
	29	0003	84	0126	275	0142	284	0109	273	0140	278	29
	30	0007	85	0121	276	0127	282	0059	272	0137	278	30
	31	0011	86	0116	276	0112	279	0049	271	0134	279	31
Jun	1	0016	87	0110	276	0056	277	0040	270	0131	280	1
	2	0020	89	0105	276	0041	275	0030	269	0128	281	2
	3	0024	90	0100	276	0025	272	0020	268	0125	282	3
	4	0029	91	0054	276	0010	270	0011	268	0123	283	4
	5	0033	92	0049	277	0153	298	0001	267	0120	283	5
	6	0037	93	0044	277	0138	295	0151	296	0117	284	6
	7	0042	94	0038	277	0122	293	0141	295	0114	285	7
	8	0046	95	0033	277	0107	291	0131	294	0111	286	8
	9	0051	96	0028	277	0052	288	0122	293	0108	287	9
	10	0055	98	0022	278	0036	286	0112	292	0106	287	10
	11	0059	99	0017	278	0021	284	0102	291	0103	288	11
	12	0104	100	0012	278	0005	281	0053	290	0100	289	12
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CORRECTIONS

In "Build the Deadeye Dish Controller," which appeared in the April issue of *73*, an incorrect part number was given in the parts list on page 91. The two 1-12 position switches were identified as Radio Shack number 257-183. The correct identification is Radio Shack number 275-1385.

Avery L. Jenkins WB8JLG
73 Staff

In the results of *73*'s 1st annual 40/80 phone contest on page 105 of the January, 1983, issue, the 40-meter single-operator champion of Norway was incorrectly identified as LA5YF. The correct winner is Bjorn-Hugo Ark LA5YJ. Our apologies to Bjorn for the error.

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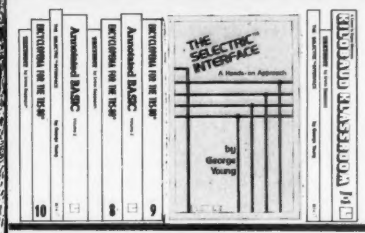

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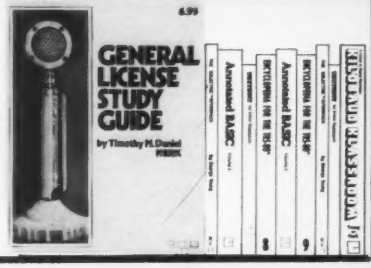

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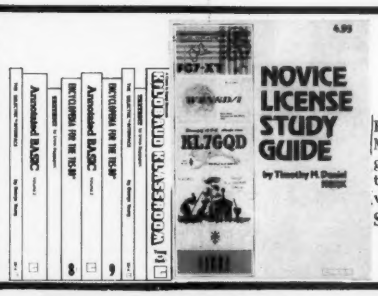

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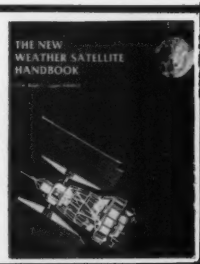

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CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

ARMED FORCES DAY COMMUNICATIONS TESTS
Starts: 1300 GMT May 21
Ends: 0245 GMT May 22

This year's observance of Armed Forces Day marks the 34th anniversary of communications tests between the amateur radio fraternity and military communications systems. Since 1950, this event has been scheduled during the month of May and has emphasized a continuing climate of mutual assistance and warm esteem. Saturday, 21 May 1983, has been designated as the 34th Annual Armed Forces Day.

A featured highlight of the nationwide celebration will be the traditional military-to-amateur crossband communications tests. These tests give amateur operators an opportunity to demonstrate their individual technical skills and to receive recognition from the Secretary of Defense or the appropriate military radio station for their proven expertise.

The proceedings will include operations in continuous wave (CW), single sideband voice (SSB), radioteletype (RTTY), and slow-scan television (SSTV).

Special commemorative QSL cards will be awarded to amateurs achieving a verified two-way radio contact with any of the participating military radio stations. Those who receive and accurately copy the Armed Forces Day CW and/or RTTY message from the Secretary of Defense will receive a special commemorative certificate from the Secretary. Interception by shortwave listeners (SWL) is not acknowledged by QSL cards, however, anyone can qualify for a certificate by copying the Secretary's message.

CROSSBAND CONTACTS:

The military-to-amateur crossband operations will be conducted from 1300 GMT, May 21, to 0245 GMT, May 22. East coast stations commence operations at 1300 GMT, May 21 and west coast stations commence operations at 1600 GMT, May 21. Military stations will transmit on selected military frequencies and listen for amateur stations on those portions of the amateur bands indicated—see box. The military operator will announce the specific amateur band frequency to which he/she is listening. Duration of the contact should be limited to 3 minutes.

CW RECEIVING TEST:

The CW receiving test will be conducted at 25 words per minute. The broadcast will be a special Armed Forces Day message from the Secretary of Defense to any amateur or SWL operator desiring to participate. A 10-minute call for tuning purposes will begin at 0300 GMT, May 22. The Secretary's message will be transmitted 0310 GMT, May 22 from the following stations on the listed frequencies:

6995.5, 13997.5 kHz—AIR, 2045th Communication Group, Andrews Air Force Base, Washington DC.

4005, 7645, 14400 kHz—NAM, US Naval Communications Area Master Station, Norfolk VA.

7385, 13975.5 kHz—NAV, HQ Navy-Marine Corps MARS Station, Cheltenham MD.

4010, 7365, 13927.5 kHz—NPG, US Naval Communications Station, Stockton CA.

4028.5, 6997.5, 14403.5 kHz—WAR, US Army MARS Radio Station, Fort Meade MD.

RADIOTELETYPEWRITER RECEIVING TEST:

The radioteletype (RTTY) receiving test will be transmitted at 60 words per minute. Radio station AIR will transmit using 850-Hertz (wide) shift. All others will transmit using 170-Hertz (narrow) shift. A 10-minute call for tuning purposes will begin at 0335 GMT, May 22. The special Armed Forces Day message from the Secretary of Defense will be transmitted at 0345 GMT, May 22. This test is to exercise the technical skill in aligning and adjusting equipment by the amateur radio operator. Transmission will be from the same stations and frequencies as listed above for the CW receiving test.

Station	Military Frequency	Emission	Amateur Band
AIR	4025 kHz	LSB	3800-4000 kHz
2045th Communication Group	6995.5 kHz	CW	7025-7150 kHz
Andrews Air Force Base	7135 kHz	LSB	7225-7300 kHz
Washington DC	13997.5 kHz	CW	14025-14075 kHz
	14389 kHz	USB	14275-14350 kHz
NAV	7385 kHz	RTTY	7090-7100 kHz
HQ Navy-Marine Corps MARS Radio Station Cheltenham MD	13975.5 kHz	SSTV	14225-14250 kHz
NMH	4040 kHz	CW	3500-3650 kHz
US Coast Guard Radio Station	7346.5 kHz	LSB	7150-7300 kHz
Alexandria VA	14440 kHz	RTTY	14080-14100 kHz
NPG	4008.5 kHz	LSB	3800-4000 kHz
US Naval Communications	4010 kHz	CW	3650-3750 kHz
Station	6970 kHz	CW	7025-7150 kHz
Stockton CA	7301.5 kHz	LSB	7250-7300 kHz
	7365 kHz	CW	7025-7150 kHz
	13827.5 kHz	RTTY	14080-14100 kHz
	13927.5 kHz	CW	14025-14075 kHz
	14470 kHz	USB	14200-14350 kHz
	20950 kHz	CW	21000-21200 kHz
	20998.5 kHz	USB	21360-21450 kHz
NPL	7380 kHz	RTTY	7090-7100 kHz
US Naval Communications Station San Diego CA	14385 kHz	SSTV	14225-14250 kHz
(Note—SSTV from NPL will run from 1600-2400 UTC 21 May 1983)			
NZJ	7375 kHz	RTTY	7090-7100 kHz
Marine Corps Air Station El Toro CA	14480 kHz	USB	14275-14350 kHz
WAR	4028.5 kHz	LSB	3775-4000 kHz
HQ US Army MARS Radio	6997.5 kHz	CW	7000-7150 kHz
Station	13992.5 kHz	USB	14200-14350 kHz
Fort Meade MD	14403.5 kHz	(see operating schedule below)	
	20995.5 kHz	USB	21270-21450 kHz

Emission	Time	Amateur Band
RTTY	1300-1500, 1800-2200, 0100-0300	14080-14100 kHz
CW	1500-1800, 2200-0100	14025-14075 kHz

CALENDAR

May 21-22	**Armed Forces Day Communications Tests**
Jun 11-12	**ARRL VHF QSO Party**
Jun 25-26	**ARRL Field Day**
Jul 9-10	**IARU Radiosport Championship**
Jul 15-17	***A5 Magazine* SSTV DX Contest**
Aug 6-7	**ARRL UHF Contest**
Aug 19-21	***A5 Magazine* UHF FSTV DX Contest**
Aug 20-21	**SARTG Worldwide RTTY Contest**
Sep 10-11	**ARRL VHF QSO Party**
Oct 8-9	**ARRL QSO Party—CW**
Oct 9-10	**ARRL QSO Party—Phone**
Oct 15-16	**ARRL Simulated Emergency Test**
Nov 5-6	**ARRL Sweepstakes—CW**
Nov 19-20	**ARRL Sweepstakes—Phone**
Dec 3-4	**ARRL 160-Meter Contest**
Dec 10-11	**ARRL 10-Meter Contest**

CARI News

CHESS & AMATEUR RADIO INTERNATIONAL

NEWSLETTER OF THE MONTH

This month's newsletter contest winner is produced by a group of hams promoting international goodwill by playing a war game.

The *CARI News* (Chess and Amateur Radio International) is the forum for a new and growing group of hams organizing their on-the-air chess games around nets and established calling frequencies. Vince Luciani K2VJ, founder of the group, reports that although the club has been established only since July, 1982, it has 100 members and represents six countries.

The newsletter has a different atmosphere than most because, unlike most club members, the hams of CARI rarely get a chance to see one another. So the newsletter is the medium used to keep members up to date on more than the latest events, games, and tournaments.

The lead story from one recent issue dealt with a tournament between two chess clubs—one in Massachusetts and one in Canada—that was made possible by the CARI net. But the article went beyond a simple recounting of events and offered up some advice to members planning a similar event.

Advice and assistance seem to be goals of the *CARI News*; other features included a discussion of the two forms of chess notation currently in use and the best format for transmitting moves. Suggestions on how to start or check into a CARI net were presented, as well as a list of the organization's nets on the HF bands.

On the inside, the newsletter carried an interesting story about an over-the-air chess game between N1BHL and the Fidelity Prestige Challenger—a highly-rated chess computer. Out of three games, N1BHL resigned one, drew on the second, and won the third.

Much of the newsletter is devoted to correspondence from members with improvements, gripes, or questions. Vince says he aims to make people "think of us more as a personal group than as a newsletter."

"By joining CARI you are joining a movement to put chess on the air anytime and at your convenience," Vince said in a recent issue. "*CARI News* will serve as the means by which we hope to regularly put it all together, but it can't be the only reason to join CARI."

If not the only reason, *CARI News* is certainly a good reason for joining, and it is a newsletter which other clubs could look to as an example.

If you think your club's newsletter is a winner, send it to Editorial Offices, *73*, Peterborough NH 03458.

Transcriptions of the CW and/or RTTY receiving tests should be submitted "as received." No attempt should be made to correct possible transmission errors.

Time, frequency, and call letters of the military station copied as well as the name, callsign, and address (including zip code) of the individual submitting the entry must be indicated on the page containing the message test. Each year, a large number of acceptable copies are received with insufficient information, or the necessary information was attached to the transcription and was separated, thereby precluding the issuance of a certificate.

Entries must be postmarked no later than 28 May 1983 and submitted to the respective military commands.

Stations copying AIR send entries to: Armed Forces Day Test, 2045th CG/DONJM Andrews AFB DC 20331.

Stations copying NAM, NAV or NPG send entries to: Armed Forces Day Test, HQ, Navy-Marine Corps MARS, 4401 Massachusetts Ave., N.W., Washington DC 20390.

Stations copying WAR send entries to: Armed Forces Day Test, Commander, 7th Signal Command, Attn: CCN-PO-OX, Fort Ritchie MD 21719.

LETTERS

MISSING THE BOAT

I think we (hams) are missing the boat on the two-GHz band! There are thousands of 2-GHz downconverters out there, and kit prices are cheap.

I would like to see someone come out in print in *73* on transmitting for 2 GHz, how to build for communications such as ATV, etc., or see some advertiser, like Universal Communications, come out with a simple transmitter—as it said a long time back it would, but has not to date.

Keep up the good work at *73*, and thanks for taking time to read my ½-cent's worth.

Larry N. Ingram WA8WOX
Augusta KS

Well, it might make semi-honest men of the 2-GHz converter crowd, so by all means, let's see some transmitters for the band. We'll publish 'em.—Wayne.

NEW CONTEST RULE

I read with great interest your editorial in the December, 1982, issue of *73* and agree with you in taking issue with the PY@SB DX-pedition in causing QRM over a 100-kHz segment of the 20-meter band. Your positive approach and suggestion for handling the pileup is a good one and I hope future DXpeditions will take note.

A related subject is that of DX contests. I love contests and participate in them, but can easily see that as they are now conducted they are a source of QRM and irritation to non-contest hams and to a lot of those in the contest, too. The practice of parking on a frequency and calling "CQ DX contest" incessantly is a prime source of QRM and unnecessary spectrum use. To the end that it frequently results in ill feelings in the ham fraternity, contesters and non-contesters alike.

Here on the west coast, DX contesting becomes a matter of primarily working a lot of different countries for multipliers and then working as many JA stations as possible to obtain a high score. It's called running a string of JAs. In recent years, many JA stations, becoming wise to this, refuse to be a part of such antics and now, instead, call CQ themselves. Of course, many of the newer JA hams will respond.

To reduce QRM and to make DX contests more fun for all participants, I propose that contest committees formulate a new rule wherein USA hams listen for and answer foreign stations who call "CQ DX contest" (i.e., USA stations would not be permitted to call "CQ DX test").

Yes, I know that overall scores would be lower and records could not be broken on this basis. However, in addition to reducing QRM, this concept would exercise, to a much greater extent, the operating skills of the USA operators. Everyone would be on more equal footing; rudeness, muscle tactics, and the number of super-power stations would be reduced.

This idea has as much chance of taking hold as a snowball in hell! I wanted to put it out for thought, anyway.

Gary Legel N6TO
Fullerton CA

Oh, let's compromise, Gary, and let 'em call CQ as long as it is above 14,300 kHz. Okay?—Wayne.

VOLUNTEER EXAMINER

As you know, Wayne, the ARRL has requested that the FCC delay any action on a codeless amateur license on the grounds that the amateur community cannot handle the training and examining job. I suspect that it is the ARRL that can't handle the job or prefers not to handle the job.

In your position as a member of NIAC and publisher of *73*, I urge you to assist in finding someone who can handle the job. Most large, well-organized radio clubs could handle the examining and training job if they chose to do so.

Provided I am not bogged down by outside red tape, I will volunteer to handle the job in Lancaster County, by myself if necessary. What I would propose to do is set up training courses through the Adult Education Department of the Lancaster County Voc-Tech schools. I would schedule a Novice class in the fall term, a General class in the winter term, and an Advanced/Extra class in the spring term. I would propose to give the FCC license exam as the final exam in each case. Voc-Tech school courses are supervised by the school administration and the Pennsylvania State Board of Education. I see no need for multiple certified ARRL examiners. In the interest of uniformity, I would prefer to have the FCC supply the exams, but this is not a necessity.

Many communities have education facilities similar to ours. I suspect that most of these educational institutions are eager to add to the scope of their programs. They are subsidized by state and local funds so the tuition is generally low. If anybody would like information on how to approach such an educational organization, I will be glad to advise on the approach.

George S. Gadbois W3FEY
141 Maple Lane
Lancaster PA 17601

Good show, George. My own approach is to push to get Congress to pass a law permitting the FCC to charge for ham licenses, set up a modest fee of, say, $10 for five years of license, and then we will be in a position where we are paying for our keep, so to speak. The next step would be to have ham clubs interested in issuing licenses ante up $1,000 to the Commission which would be put into a special investment fund... perhaps in Treasury Certificates. The interest from this investment would more than pay for our costs to the FCC. The fee would separate the serious clubs from those not truly interested in issuing licenses better than most other criteria and would be a simple test of interest. The clubs would then organize classes for those interested in licenses, ending with both an oral test on rules and theory and a proof of operating competence. Those passing could get their call letters immediately via a desktop computer and a modem connected to the FCC computer in Gettysburg. Indeed, I have discussed this concept with the Commission and not run into any serious resistance... except for the need to get authorization for the fee from Congress. Clubs could bring the deposit fees up to the $1,000 level once or twice a year as they are debited for each new licensee. I suspect that we might be able to embark on a whole new era in amateur radio enthusiasm with such a scheme.—Wayne.

LITTLE BOMBSHELL

I wonder how many hams read the little bombshell, "The Optical Computer," in the February issue of *Scientific American*? The authors have developed an optical analog of the transistor, a device which controls light in a manner analogous to the way a transistor controls electricity. As the title indicates, the authors are primarily interested in applications to digital logic, and with good reason. They have achieved switching times on the order of a picosecond in their prototypes. Would you like a computer that runs at 100 gigahertz?

The device also functions as a linear amplifier and could have profound implications for communications technology. Light energy could be manipulated with the sophistication we now apply to rf. The primary advantage is that the short wavelengths and fast switching times imply tremendous channel capacity. In principle, hundreds of millions of signals could be multiplexed on a single beam. The potential for satellite operations is especially interesting.

Maybe we should get a foot in the door for a ham band at 5 micrometers!

Mike Hughes W7KCB
Rapid City SD

SCHOLARSHIPS OFFERED

The Foundation for Amateur Radio, Inc., a nonprofit organization with headquarters in Washington DC, plans to award ten scholarships for the academic year 1983-1984. The Foundation, composed of fifty local area amateur radio clubs, fully funds two of these scholarships from the proceeds of the Gaithersburg (MD) Hamfest. It administers, without cost to the donors, two scholarships for the Quarter Century Wireless Association and one each for the Richard G. Chichester Memorial, the Radio Club of America, the Young Ladies' Radio League, the Edmund B. Redington Memorial, the Amateur Radio News Service, and the Columbia (MD) Amateur Radio Association.

Licensed radio amateurs may compete for one or more of these awards if they plan to pursue a full-time course of studies beyond high school and are enrolled or have been accepted for enrollment in an accredited university, college, or technical school. Most of the scholarships require the applicant to hold at least an FCC General class license or equivalent. The scholarship awards range from $300 to $900 with preference given in some of them to residents of specified geographical areas or the pursuit of certain study programs.

Additional information and an application form can be requested by a letter or QSL/postcard postmarked prior to May 31, 1983, from the below-named scholarship committee chairman.

The Foundation is devoted exclusively to promoting the interests of amateur radio and to the scientific, literary, and educational pursuits that advance the purposes of the Amateur Radio Service.

Hugh A. Turnbull W3ABC
6903 Rhode Island Avenue
College Park MD 20740

RTTY MANNERS

For many years, Wayne, you have been in the forefront in the ongoing fight for law and order among amateur radio operators, for more recognition, better operating conditions, more frequencies, and especially for us to clean up our act and be more considerate and gentlemanly—and ladylike—while on the air. It's this last for which I am appealing to you and your publication for help.

I don't know how much RTTY or CW you work. I have never had the pleasure of a QSO with you on any mode, and I was first licensed in 1955. But I am one of those who likes all modes and most of the bands. At present, I operate mostly RTTY, and have since 1958. But I also work a lot of CW and SSB and utilize the 160-acre band down through 2 meters. It is through my diversified operating habits that I have become aware of an increasing problem which only education and awareness can help. This problem is the growing number of "shoot-outs" occurring between RTTY and CW stations.

As you know, for more than thirty years there has existed between RTTY and CW operators a "gentlemen's agreement" setting aside certain portions of the HF bands for each mode. The simple reason for this, of course, was the incompatibility of one for the other. Naturally, the FCC neither recognizes nor has any interest in these self-imposed restrictions, so we can look only to ourselves for help.

It is the rare ham indeed who operates anything besides an SSB rig on HF. And traditionally these are operated on upper sideband in the CW mode and lower sideband in the RTTY mode. Without going into all the technicalities involved, and which you are already aware of, a CW station on the low-frequency side of a RTTY station really

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clobbers the latter, and without even knowing the RTTY station is there. The reverse is true, also. This, then, is where all the shootouts are taking place. One interferes with the other. Tempers flare. Each station then begins jockeying for position, cranks up the power, and starts blasting away at the other. Just listen around a bit and you'll see what I am alluding to. This is total insanity and would never happen if the traditional band-use agreements were observed!

It is not all that rare to find a CW station blithely calling "CQ DX" at 14.090, or a CW rag-chew or traffic net in progress between 3.600 and 3.650. It is a bit unusual, also, to tune across a RTTY QSO around 14.065, but I've certainly heard it. There are more CW violators than RTTY, but only because of two basic reasons: There are more people operating CW than there are operating RTTY; and most hams who get into RTTY are soon made aware of this gentlemen's agreement thing I've been referring to. Neither I nor most of the RTTY bunch I work would even think of moving outside the traditional RTTY turf. On the other hand, when I am operating CW, I stay well clear of the RTTY turf.

Looking at it strictly from the CW man's side, the picture is totally different. Many brag that they've never owned a microphone and that any "deedle-deedle" station is fair game. After all, one holding an amateur Extra ticket can legally operate on all the HF bands, from one end to the other, can't he? You bet, and some do. Not all, of course, for despite the growing evidence to the contrary, there still remains a goodly number of polite and considerate hams whose philosophy is "live and let live" and "everybody to his own taste." Thank God for these!

Most—not all, but most—of the stations interfering with each other in the two modes bear relatively recent callsigns. This, to me, is a sign of ignorance rather than deliberate animosity. A great many newly-licensed amateurs are initially interested only in operating phone or CW. Only a small percentage of newcomers to this wonderful hobby have even heard of amateur radioteletype and enter that facet right off. Therefore, they have little need to acquaint themselves with time-honored traditions not covered in their FCC study guides.

It is for this reason I am appealing to you, as well as to other publications in the hobby, to help. You are in touch. People read what you print. They respect your publication. They respect you. They look to you for new ideas and suggestions. I'm not asking that this letter appear in print, specifically. If you would like it to, go ahead. But it's not enough. Even a mention of the problem in "RTTY Loop" won't be enough, since it will reach only a few RTTY enthusiasts and maybe a smattering of CW people. No, it needs to be brought to the attention of the general ham population, and more than once. An in-depth discussion of the situation in one of your editorials would give you material to write about as well as help enlighten those who need enlightening. Subsequent editorials could contain brief recaps, reaching newcomers as well as reminding others of the situation.

You ask for comments. Here are mine. And thank you for listening.

Bill Skipper K0ARG
Greeley CO

Bill, I sure hope you sent a copy of your letter to QST *and that they print it so your thoughts can reach the CW fanatics out there. I doubt if many CW fans still read* 73*, despite an occasional article on a keyer. I'm not exactly of the mind-set which believes that if God had intended us to whistle at each other he would have built us that way, but I will never be a big fan of CW until it is no longer mandatory by government edict. Once the government no longer forces me to learn the code, I think you'll find me psychologically better able to cope with it. I really hate anything I am forced to do. But trying to reason with CW ops isn't the real answer to your problem. Bill, you are working with a technologically advanced mode of communications, so I suggest that you and all of the other deedle-deedle nuts start designing circuits which CW folks can't bother. Hell, you know that's perfectly possible just as well as I do. In fact, I set up a RTTY station recently using one of the new commercial units and I couldn't believe how susceptible to interferences it was. Why, compared to the circuits we were building in the late 40s, over 30 years ago, this was junk. Bill, it looks to me as if we've gone downhill in 30 years technically. Oh, we had our percentage of bad converters then, too, so perhaps I am over-reacting. I do have to admit to more enthusiasm for the new Tono unit which I got my hands on in Bangkok. Drake is selling it here. Now, that was a lot easier to tune, and it ignored interference fairly well. Oh, it could be a lot better. . . we can design circuits which will just plain reject almost anything that happens in jamming if we work at it. I'd sure like to see some articles submitted to* 73 *for publication along this line. Remember, a CW station can jam only one frequency at a time, so a good converter should check out both channels, looking for either a signal or a lack of signal in each, and then integrate the results, keeping in mind the asynchronous pattern. It is also getting high time that we started working with higher speed transmissions, developing our 9600-baud techniques and making them work. We might want to go back to 850-Hz shift, too, in order to allow the circuits to check each channel separately and to further eliminate any problems of CW interference. Let's see some work on this. If we are able to work through any attempts at jamming, we will have a nice backup for the gentlemen's agreement.—Wayne.*

BASH QUICKIE

I feel that I must respond to your comments concerning Bash books and courses as a method for passing FCC exams.

To begin with, this type of activity has been around for quite some time. Those of us who are former broadcasters remember the days of the First-phone "quickie schools." The schools filled a definite need for an industry to have licensed personnel in a situation where everyone admitted the license was unnecessary.

Now, it is true that amateur radio does not fall completely in line with this reasoning, but it seems to me that if the FCC is going to set up its tests so that someone can sell the answers, then it has only itself to blame. Furthermore, the FCC publishes study guides that a person can use, and if he knows the answers and the reasoning behind the answers, he is likely to pass the test. Is that so different from someone selling the answers?

I think that you are plugging your anti-Bash stand in order to justify a proposal for a code-free license. You point out that it is hypocritical to require code and not technical knowledge, but the two are completely different. Morse code can be quite easily learned, but technical prowess doesn't come easily. Many people still struggle to understand solid-state theory, and while I can build simple transistor rf amplifiers from scratch and I can tell you when a transistor is on or off given certain bias conditions, I couldn't begin to design a transistor amplifier.

Technical knowledge comes at different levels of understanding. It is one thing to know that a basic antenna is a quarter wavelength long, but it is quite another to know how that antenna works with its ground system and how to match it to a 50-Ohm coaxial cable. And I don't think that there are too many hams who would know how to design a ground-mounted vertical system complete with radials and matching network and then put it all together and make it work. I think that in any technical field related to ham radio you will find people who have different levels of understanding, and I think that, quite properly, some of us may have no technical understanding.

I agree with James Burke, author of *Connections*, that any person has the ability to understand something technical as long as the explanation is made simple enough. But has the explanation been made simple? Is understanding how it works worth the time if it is not directly related to your particular interest in amateur radio?

While it may be true that CW scares many people off from ham radio, I think that the technical requirements scare some also. It just happens that of the two requirements, it is easier to "bash" the technical. I do not think that it follows that because we are not overly strict on the technical requirement we should drop the CW requirement. Again, the two are entirely different. One can easily understand Newton's Laws of Motion, but one may not be able to perform the mathematical gymnastics to derive the laws. Furthermore, I do not think that technical knowledge equates with ability to work on equipment. Most hams might understand how their PLL synthesizer works in the hand-held, but I don't think that too many would want to jump in and try to fix it. Is that wrong? Of course not; it's just prudent!

For the record, I am a lawyer. I hold an Advanced license and have flunked the Extra CW once. I have successfully built many antennas, an antenna tuner, simple rf power amplifiers, and a dummy load, all from scratch. I read many technical articles and basic theory articles, i.e., *Solid State Design for the Radio Amateur*, etc., but I certainly can't design that stuff!

Kieman Holliday WA6BJH/4
Springfield VA

Yep, you're a lawyer.—Wayne.

OPTIONAL CW

I've been receiving your magazine for several years and can honestly say it doesn't lack for controversy. However, I have not seen anything in years to compare with the no-code license hullabaloo in these pages lately.

The no-code license proposal does have its merits, in that it would encourage those with an interest in learning more about radio but deficient at CW skills to pursue that interest on a limited basis in a small part of the radio spectrum.

Opponents maintain that anyone can learn CW. Well, that may be true, and if so, it doesn't screen out the lids. With the Bash books available, anyone can get on the air with only the faintest idea of what they are talking about. Other opponents don't want newcomers to have any easier time of it then they did (a classic argument). How many of you, then, can honestly copy CW at your tested speed?

Perhaps what is needed is some sort of skill examination in conjunction with a standard test of basic theory and radio

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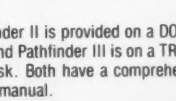

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laws. This would serve two purposes: First, it would ensure that any exam is cheat-proof. Second, it would encourage the applicant to pursue a "hands-on" learning session about ham radio. Such a skill could be to build a kit. Perhaps the applicant is one of many with an interest in computers and could design a logging program. Maybe even build a small antenna!

Of course, CW could be retained as an elective skill. The point is to get the applicants off to a good start by encouraging an early desire to learn more about radio, and carry it through the rest of their days—not to approach the CW test as a nuisance to be forgotten once the ticket is in hand.

I'm not calling for the abolition of CW. It is an international requirement, and I found it possible to master 20 wpm with some work. It's my favorite contest mode! But, I like chocolate; others prefer vanilla. For an entry-level test, perhaps there is a way to get more newcomers into a dynamic hobby, and I feel that a skill exam may be just the way. If we got more builders instead of DX chasers on 20 as a result, it wouldn't be a bad move.

After all, no-code licenses work well in Europe and Japan. I have yet to hear one good reason why they won't work in the USA.

Peter H. Putnam KT2B
Morris Plains NJ

Troublemaker.—Wayne.

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Just wanted to let you know of the fine customer service afforded me by one of your advertisers.

After having purchased a RTTY interface unit for my computer from Ridge Systems of Acton, Massachusetts, I experienced some difficulty in putting it into operation. I called the Ridge factory, and in a couple of days Dave Beverage, factory engineer, and "Franco," also of Ridge, appeared at my front door.

In a short time they discovered the problem to be in the computer and not their interface unit. They could have stopped right there and left, but instead they proceeded to disassemble my computer, remove the internal PC board, find the problem (a Tandy factory-wired short), and reassemble the machine (a color computer).

After a thorough checkout of the equipment, Dave then gave me extra instruction on using the interface. When he was sure all was well, he and Franco picked up their tools and left—no charge!

The RTTY unit has been operating perfectly ever since, and I not only recommend it to other color-computer owners but find that I can also recommend the company behind it.

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FUN!

John Edwards KI2U
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THE POSTMAN GETS MAD

Sometimes, I get the feeling that this yearly FUN! poll is getting out of control. Each year, more ballots come in and the work gets harder. Take this year's poll for example, 1,190 of you sent in ballots. This time around it took four people and three computers to tabulate the results (a TRS-80 Model III, an Apple IIe, and an Atari 400, for those of you who care).

This time, for the first time, my mailman spoke his mind. Now, for all of you who addressed your envelopes "Attn: FUN! Poll" or wrote "FUN! Department" in the lower-right corner, let me point out that I live in a rather small, one-family home lodged in an area of New York City that one of my friends calls "Archie Bunker land." My home does not have a mailbox; it has a tiny slot next to the front door. This means that my mailman had to slip each of the letters (up to one hundred a day) through the slot one or two at a time. By the third day, the poor man finally gave up, rang the doorbell, and with a firmly set snarl said, "I don't know what this fun stuff is, but it ain't no fun for me." Before I had a chance to answer, he turned on his heel and trudged away. From there on in, he would merely ring my doorbell, hand me my mail, and say, "Here's your fun mail!" Funny he didn't even answer me when I asked if a mail sack would help.

Here's what you had to say:

ELEMENT 1—BACKGROUND

1) Sex:
A) Male—89%
B) Female—11%
A two-percent increase in female amateurs over 1982 and a five-percent increase since 1981. A definite trend is developing.

2) Age:
A) 15 or below—4%
B) 16-21—6%
C) 22-39—37%
D) 40-59—36%
E) 60 or above—17%
As the numbers show, not many young respondents to the poll. Either amateurs are getting older or the kids have forgotten how to write.

3) License class:
A) Novice—7%
B) Technician—8%
C) General—26%
D) Advanced—44%
E) Extra—15%
More Advanced and Extra holders, fewer Novices, Techs, and Generals compared with last year.

4) Number of years licensed:
A) 1 year or less—1%
B) 1-5 years—32%
C) 6-10 years—12%
D) 11-20 years—30%
E) 21 years and up—25%
A breakdown similar to last year's results.

5) Do you have a new (post-March '78) call?
A) Yes—46%
B) No—54%
Somehow, those "new" calls just don't seem so strange anymore.

6) How many hours a week do you devote to amateur radio?
A) 0-1 hour—4%
B) 2-5 hours—30%
C) 6-10 hours—42%
D) 11-20 hours—18%
E) 21 hours or more—6%
Pretty much the same results as last year.

7) Which HF band do you use most?
A) 80-75 meters—18%
B) 40 meters—23%
C) 20 meters—22%
D) 15 and/or 10 meters—25%
E) Don't operate HF—12%
A big dip in 15/10 operation—down 18% in two years.

8) Which VHF-UHF band do you use most?
A) 6 meters—1%
B) 2 meters—75%
C) 220 MHz—4%
D) 420 MHz and/or up—2%
E) Don't operate VHF-UHF—18%
Same old story, 2 meters or nothing.

9) Which mode do you use most?
A) SSB—45%
B) CW—18%
C) FM—28%
D) RTTY—6%
E) Other—3%
CW is down for the third year in a row.

10) How much money have you spent on amateur radio within the past year? (Include QSL expenses, magazine subscriptions, club dues and other incidental expenses.)
A) 0-$250—45%
B) $251-$500—29%
C) $501-$1,000—20%
D) $1,001-$2,500—4%
E) $2,501 and up—2%
Depressing figures, depressing economy.

ELEMENT 2—SOCIAL CHARACTERISTICS

11) Has amateur radio influenced your career choice?
A) Greatly—27%
B) Somewhat—24%
C) Not at all—49%
Static figures.

12) Do you answer QSLs that include a self-addressed, stamped envelope?
A) Yes—75%
B) No—25%
No big change here, either.

13) Politically, how would you define yourself?
A) Conservative—48%
B) Middle-of-the-road—49%
C) Liberal—3%
Even more of a conservative tilt than last year.

14) Do you think amateur radio will exist 20 years from now?
A) Yes—91%
B) No—9%
More optimistic than last time around.

15) How old were you when you first became a ham?
A) 15 or below—14%
B) 16-21—49%
C) 22-39—23%
D) 40-59—9%
E) 60 or above—5%
Just goes to show, you gotta get 'em when they're young.

16) Were you a CBer before you became a ham?
A) Yes—62%
B) No—38%
Give me a break.

17) Do you own a home computer?
A) Yes—41%
B) No—59%
Someday, 100% yes.

18) Do you think hams, when compared with computer hobbyists, are:
A) More technically inclined in their hobby—23%
B) Less technically inclined in their hobby—41%
C) Both are about equally skilled in their hobby—36%
I think there was some confusion between hobbyists and home-computer users.

19) Do you think that home computing is siphoning people (including youngsters) away from amateur radio?
A) Yes—71%
B) No—29%
Noting the obvious.

20) Did you ever use a "cheat book" (not counting the *ARRL License Manual*) to upgrade your license?
A) Yes—22%
B) No—78%
The "yesses" are growing.

21) If someone offered you ten million dollars, tax free, on the condition you give up amateur radio forever, would you?
A) Yes—83%
B) No—17%
In three years we've gone from one to five to ten million bucks. When we raised the ante from one million to five million, we got 20% more positive replies. Now that we've upped things by another five big ones, we only received a two-percent increase. Guess we hit a ceiling.

22) Do you belong to a local ham-radio club?
A) Yes—40%
B) No—60%
A little down from last year.

23) Have you ever attended a ham flea market?
A) Yes—81%
B) No—19%
A little up from last year.

24) Do you think the new ARRL leadership is better than the previous administration?
A) Yes—71%
B) No—29%
Good news for Newington, but many voters said we should have included a "no opinion" choice. Mea culpa.

ELEMENT 3—OPERATING HABITS

25) Should Novices have phone privileges?
A) Yes—64%
B) No—36%
As long as they know the code, right?

26) Do you think US phone bands should be expanded at the expense of foreign-station-only bands?
A) Yes—81%
B) No—19%
Are you listening, FCC?

27) Have you ever used a personal computer in connection with your amateur radio activities?
A) Yes—19%
B) No—81%
Seems a little low.

28) Is it time to completely deregulate amateur radio by having the FCC turn over all responsibility for ham operation to the amateur community?
A) Yes—55%
B) No—45%
Not a mandate by any means.

29) Where do you think the future of ham radio lies?
A) On the HF bands—9%
B) On the VHF-UHF bands—91%
So what's holding everyone back?

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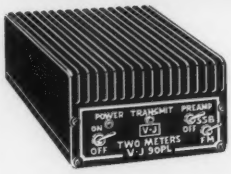

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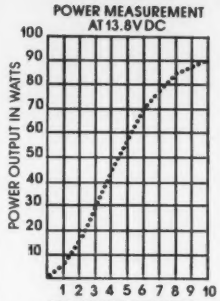

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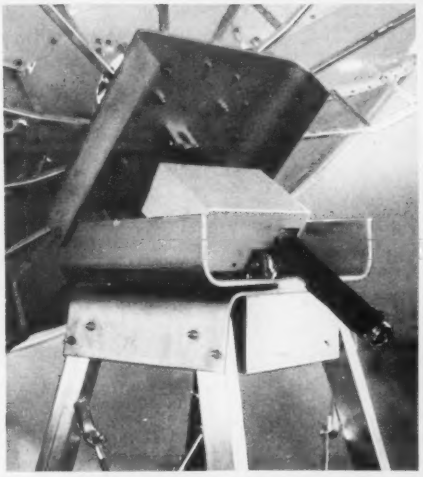

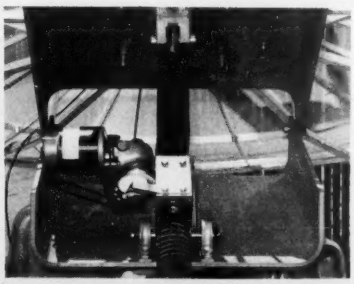

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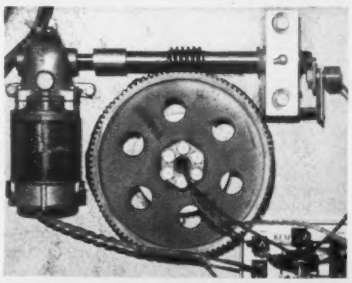

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30) Should we get rid of, or reduce in size, the CW subbands?
A) Yes—66%
B) No—34%
Time to trim the band chart.

31) Do you think religiously-oriented nets have a place in ham radio?
A) Yes—42%
B) No—58%
Amen.

32) Do you think politically-oriented nets have a place in ham radio?
A) Yes—70%
B) No—30%
Free speech lives!

33) If, while tuning across a band, you heard a net of gay hams in progress, would you:
A) Jam it—5%
B) Ignore it—62%
C) Complain to the FCC or some other organization—12%
D) Listen—19%
E) Join it—2%
I think that's a healthy attitude.

34) If, while tuning across a band, you heard a net called "The American Communist Radio Society" in progress, would you:
A) Jam it—7%
B) Ignore it—61%
C) Complain to the FCC or some other organization—15%
D) Listen—17%
E) Join it—0%
See the above comment.

35) If required, could you solidly copy CW at the speed at which you were licensed?
A) Yes—77%
B) No—23%
Either our readers keep in shape or are hopeless liars.

36) If required, could you pass the FCC theory test for your license class without consulting a "cheat book"?
A) Yes—74%
B) No—26%
See above comment.

37) Have you ever purposely operated in an amateur subband you weren't licensed to use?
A) Yes—13%
B) No—87%
These figures have remained about the same over three years.

38) Do you think the FCC affects amateur radio in a positive manner?
A) Yes—15%
B) No—85%
The positive reponses have been creeping upward.

39) Do you ever speak to foreign, non-English-speaking hams in their own language?
A) Always—4%
B) Sometimes—17%
C) I attempt it—23%
D) Rarely—4%
E) Never—52%
No major change here.

40) Do you feel competent to replace the finals in a tube-type rig?
A) Yes—94%
B) No—6%
Tube pins are generally tougher to bend than IC pins.

41) Do you feel yourself competent to replace the finals in a transistor-type rig?
A) Yes—83%
B) No—17%
No pins on transistors.

42) Have you ever built an electronic project from a kit?
A) Yes—97%
B) No—3%
Heath, Radio Shack—take note.

43) Have you ever "home-brewed" an electronic project from a book or magazine?
A) Yes—71%
B) No—29%
Lots of fun.

44) Have you ever designed your own electronic project?
A) Yes—57%
B) No—43%
How about an electronic frequency clearer?

45) What do you think of contesting?
A) Great—15%
B) Good—20%
C) Okay—14%
D) Don't like it—23%
E) Despise it—28%
A sleepless night, sore throat, frazzled nerves—what's not to like?

46) What do you think of DXing?
A) Great—43%
B) Good—29%
C) Okay—11%
D) Don't like it—7%
E) Despise it—10%
The quest for the Honor Roll.

47) What do you think of repeaters?
A) Great—30%
B) Good—13%
C) Okay—37%
D) Don't like them—11%
E) Despise them—9%
Ham radio's answer to Channel 19. Only joking.

48) What do you think of traffic handling?
A) Great—7%
B) Good—31%
C) Okay—28%
D) Don't like it—11%
E) Despise it—23%
In Sam Morse's footsteps.

49) Do you plan to use Phase III Oscar within a year of its launch?
A) Yes—30%
B) No—70%
If Ariane doesn't land in the drink again.

50) Do you plan to use the new 10.1-MHz band within one year of its opening?
A) Yes—12%
B) No—88%
The FCC jumped the gun on this one and actually opened the band before the question got into print. In any event, thé question was still valid and 12% of you should be enjoying your new privileges right now. By the way, 40% of you said "yes" last year. What happened?

SELECTED COMMENTS

I think that non-code exam-type licenses should not be allowed. Ham radio has always revolved around CW and should continue to do so.—N6BWJ.

I work in a large ham store and, frankly, the helplessness of today's "Bash" ham is embarrassing. I had a General-class ham ask me if longwave was more powerful than FM.—N6BPL.

Fun, John, Fun! The best part of this response is that I get to cut up Wayne's "NSD" column Hi!—N1BLL.

A full life is possible without amateur radio. Only a dinosaur becomes too specialized—hobbies are swell but are not essential to life.—Mary MacKenzie, Portland OR.

The FCC plan to have ham clubs handle licensing is the poorest idea they have ever had. The abuse by Bash of the license system would look like harmless child's play compared to the certain sale of licenses to people who don't know the code or can't pass even the simplest technical exam. If amateur radio is to survive, this will not be the way. Ham licenses for a $100 donation, anyone?—KJ7F.

The only foreign language I took was Latin.—K8BNO.

Religion, politics, gays, and reds don't have a place in ham radio. Please forward information to me about anyone who answered "E" for 33 and/or 34.—KA2NNQ.

Amateurs are an unusual class of people. You run into them in a crowd and they stand out as being conservative—serious about their hobby—and willing to help—especially people interested in amateur radio. This is true the world over.—W9MGQ.

This quiz is a good reminder to me of how I've changed my opinions and operating habits over the years.—AJ2X.

How about a hundred questions next year?—KB7WL.

W2NSD/1
NEVER SAY DIE
editorial by Wayne Green

from page 8

party publisher to bring unbiased information to users, I can't honestly recommend it.

Remember when you see these great prices that without good software and user information as supplied almost exclusively through system-specific magazines, you are asking for a lot of grief.

SOLVING THE JOBS PROBLEM

With about half of the steelworkers out of work and half of the auto workers looking for jobs, one reads the papers and attends the television panel discussions exhaustively investigating the jobs subject with a growing conviction that things are a bit out of kilter.

On the one hand, I read that the reason our car manufacturers are unable to compete with Japan is that our auto workers are averaging double the American wage, while the Japanese workers are making the average Japanese wage. The immediate response is to wonder at the greed of the unions which pushed the wage scale so out of balance. It appears that if the auto workers who are still working were to accept the average American wage level, there would be no unemployment in that industry. And apparently the same goes for the steelworkers.

Of course, both of these industries have problems more deep-seated than just union-escalated wages. In addition to American auto workers getting double the average wage, they are taking almost double the amount of hours to make a car. The finger here seems to point again at union pressures to prevent automation because it takes away jobs.

I watched this line of "thinking," if that is the right word for it, in the printing business. Unions fought viciously to prevent the modernization of typesetting and printing, with the result that printers have now lost most of the typesetting business, which has been taken over by far more efficient departments in businesses which need the printing. The printing unions, using strikes and terrorist tactics, have managed to cripple what was once a major industry.

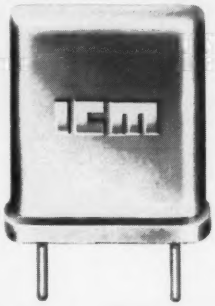
Union pressures forced printers to employ hopeless incompetents at incredible wages for years, all the while preventing changes in equipment or systems which would bring economies. When I worked in television, I saw the same union pattern in the theatrical business. Territorial disputes between unions were often vicious. The wages of stage hands, not a terribly exacting job or one calling for much in the way of experience or intelligence, were kept incredibly high by iron control of the union. One had to virtually be born into the union to join, and the theater which did not pay the stage hands between the first and second acts on Friday did not have a second act.

With the era of fast communications and transportation making this a world community, national unions are at a disadvantage trying to control industries. The original idea for unions was wonderful . . . as a bargaining group to counter the tendency of manufacturers to take advantage of workers. And they did. But there was nothing to stop the unions once they got going. They built up money, which is equivalent to political power, and some went right past equity into severe greed, possibly putting to shame the greed of the manufacturers which started the whole thing.

One of these days a whole new concept may emerge . . . one equating to some degree the contributions of people to their income. Yes, I realize that this is anti-socialist and anti-communist and thus probably likely to earn me a lot of scathing replies. The concept of taking as much away from the rich as possible, no matter what they have contributed to the country in exchange for the riches, is deeply rooted. England has done a darned good job of that, with the observable result that the country is a mere shadow of what it was when they had both rich and poor people, not just mostly poor people.

Hams who use their hobby to learn more about electronics are sitting pretty if a concept of getting paid for value ever emerges. The opportunities for working with digital communications is wide open for us these days. I see every sign that the FCC is finally going to break loose and allow us to experiment and develop new communications systems. This means working with RTTY, ASCII, error-correcting systems, packet radio, and so on.

Repeater groups will want to start working with secondary digital relaying systems, possibly using a store and relay memory system in them and interconnecting repeaters for extensive links. The people who use this excuse to gain personal experience in working with and designing circuits will, I suspect, never have to worry about a job. And many will be able to take



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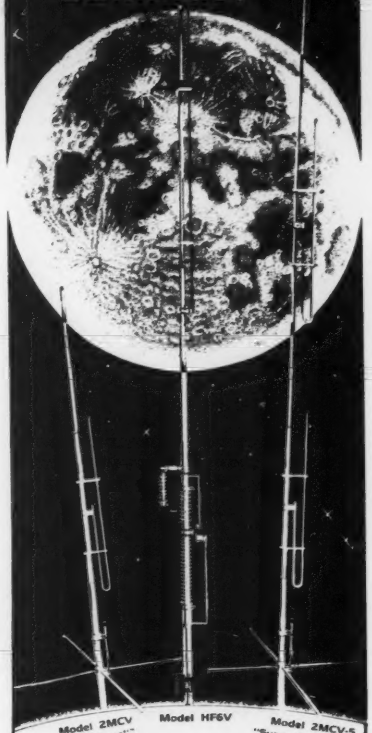

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this experience and escalate it into the start of a new firm of their own.

There have been a lot of ads looking for support for black colleges, with the headline that a mind is a terrible thing to waste. Well, it isn't just black minds which are being wasted here. A frightening part of America is made up of people with good minds who have been pushed into a life pattern which makes little use of their minds. In school, it is managing to get by via memorizing enough to pass tests and spending most of the waking time screwing around, drinking beer, and so on.

Out of school, one takes a job and gets married, goes home to some more beer and the ever-present television. Going out means McDonald's or Burger King... or a bar and an occasional movie. Television takes care of most of the need for entertainment. You've read how many hours a week the average person is in front of the TV set. There's nothing in that schedule for advancing one's education and expertise.

The kid who gets involved with a high-tech hobby in school has a tremendous advantage. There are no bread lines for electronics or computer technicians, only thousands of jobs advertised in the papers from coast to coast. The microcomputer field could easily provide handsome incomes for at least 50,000 people with the ability to repair computers. For a ham with any background in digital work, such as RTTY, getting the hang of computer repair is a snap.

And I don't think I would have much problem in finding work for at least 100,000 programmers. That wouldn't even begin to scratch the surface which is developing in software needs.

There is no easy way to get out of the fix the country has gotten itself into. Unions and other groups who have gotten an edge on the rest of us are protecting that edge with vigorous political power, putting the pressures on the weakest of senators, and you know who I mean. We see them bowing and scraping to the pressure groups every day on the news broadcasts, championing the poor on the one hand, and with the other making sure they stay poor by giving as much as possible to the groups which are getting more than their share and keeping the politicians in office.

Hams, if they don't screw up by wasting their golden opportunities to learn (and that is what *73* is all about), will never have to worry about jobs. I get a bit discouraged when I run into hams who spend 100% of their time wheezing over repeaters or on nets on the low bands, never making any effort to try something new... and, at best, writing in angry letters when we present new ideas and technologies in the magazine.

The fact is that despite the slight growth of amateurs, fewer than ever are reading *any* ham magazines at all. Please tell me of what value a ham is to himself or to the rest of us if he not only has no understanding of technology, but isn't even interested enough to read about it? You want to see something interesting? At the next club meeting ask for a show of hands of members who are getting a ham magazine. I think you'll be surprised at how many are not only ignorant about amateur radio, but also have no real interest in learning.

Clubs are a key to not only rejuvenating amateur radio, but also to getting our whole technology moving ahead. Few ham clubs are so dead that at least one member of the club isn't into RTTY, ASCII communications, packet radio, slow-scan television, ATV, OSCAR, or *something* different from rag-chewing or DXing. Get these chaps to give a talk on the fun they are having... with some hints on how to join in the fun. If someone is into building, be sure they have a chance to show off what they've built. You could just get some more club members interested. Maybe someone in the club has started a small electronics, ham, or even a computer-oriented business... well, get 'em to tell everyone about it. Help them and infect the group with the enthusiasm.

We have enormous potential. We have one of the most fascinating hobbies there is... though this is one of the best kept secrets in the country, if not the world. And with the coming need for people who understand communications, never have the prospects been better for using a hobby to provide a stepping stone into business. Thousands of new businesses are needed and will be formed, making thousands more millionaires. Are you going to be part of the fun or one of those watching the next Super Bowl game with a cold six pack at your elbow, wondering how come so many of your ham friends are getting rich?

THE ULTIMATE EMERGENCY

Nuclear war is still more of a science fiction concept than one which has to be faced as a reality. Yet, if you've seen some of the recent evaluations of the situation, it is getting obvious that whether we want to believe that such a war is possible or not, we can no longer just refuse to face the problem.

About five years ago there was a film on television which showed a comparison of the US and the USSR as far as a nuclear exchange was concerned. The SALT agreement set up a situation where both countries agreed not to pursue civil defense protection of the cities, resulting in a sort of mutual hostage situation. Of course, Russia immediately embarked upon a massive development of underground protective areas. We, on the other hand, virtually disbanded our civil defense program. The estimate was that a nuclear exchange between the two countries would probably result in about 100 million Americans getting killed as opposed to perhaps only 20 million Russians.

Not only have they set up extensive protection for their people, but a good deal of their manufacturing has been protected. And their efforts have been continuing, with one recent estimate that their losses might today be down to only five to ten million. Well, these are just figures, so nit-pickers can argue their validity, but the basic idea of what has been going on should give us some pause.

Well, the more the USSR outmaneuvers us with missiles and civil defense measures, the more serious is going to be the need for a well-developed emergency communications system. The only thing which can keep us together as a country is the ability to keep some sort of communications between our people and our government. Without that we cease to exist as a country.

The FCC is not unaware of this situation and it has made a major move to do something about this growing need for an emergency communications system which will be available for any emergencies, right on up through a full-blown nuclear war. They started with the National Industry Advisor Committee concept (NIAC), small subcommittees made up of volunteer advisors from industry. These NIAC groups have been around for several years but have not been very active or productive. Perhaps the most active of them has been the amateur radio subcommittee during the last two years.

The Commission in January set up a Long Range Planning Committee (LRPC) made up of top people from our communications industry. This committee has been set up, in essence, as a steering committee for four revamped NIAC subcommittees. The aim for this is the setting up of an integrated emergency communications system.

Though more and more of our government agencies are arranging for intercommunications during emergency situations, nothing has been organized in the way of an overall intercommunications system between government and all civilian radio groups. There seems little likelihood that such an overall system will not depend heavily upon radio amateurs. In this I think we may have a very exciting future ahead of us. Amateur radio is getting to be perceived as needed—by the government, by the communications industry, and by civilian groups.

No matter how bad the battering, when the dust starts to settle, some ham is going to dig his way out of a cave, grab his radio out, and see who is on the air so he can start getting things together. HTs and mobile rigs will be set up for local communications, low-band rigs for area and national communications. The world, what is left of it, will want to know what is happening, and the chances are that it will be hams who will be the link.

Rather than wait until we're needed for this ultimate emergency, we'll do better if we get started now setting up the communications systems we may need. We can start with what we've got—improving our repeater systems, linking them through both microwave and low-band links. But if we're going to get very far with this, we're going to have to get going with some badly needed technical developments. Voice communications may do when there isn't much traffic, but if anything serious happens, voice channels will be quickly swamped and we're going to need high-speed digital communications. We won't have that unless we start working on it now.

Over the next few years, I expect that we will be called upon for several things as a group. First, it should not surprise us if both the government and industry start getting serious about the need for the growth of amateur radio. The need for engineers and technicians for the government and industry is getting desperate and no better source of really dedicated technical people has been found than amateur radio. We're going to be called upon to start a big movement to attract the 10-15-year-olds into our hobby. This means new programs for our clubs, cooperation with local schools, and so on.

Amateur clubs are a natural for setting up intergroup communications. In emergencies it is crucial to make it possible for all two-way radio users to have some common link.

As a member of the newly formed LRPC and also a member of the private radio NIAC, I've started a dialog with the communications industry leaders. I have good reason to believe that we can expect to get cooperation with industry and government in developing amateur radio growth. I think we are going to be able to start setting up some repeater-to-repeater communications systems via the commercial satellites, using spare channels. These will start out mostly with voice channels but will gradually change over to digital high-speed channels as we improve our technology.

This isn't anything we can seriously tackle with a bunch of old men staggering around with their walkers. We are going to have to come to grips with the need for youngsters and find out how to attract them. Whether that is going to take a no-code license or what is your problem. You work it out and let me know so we can get some movement ahead. I will say this: Good luck on trying to explain to kids why Morse code is important for the development of the needed high-speed communications system... or even for voice communications.

SURVIVING EMP

Electromagnetic pulse (EMP) is a partner of nuclear blasts. Getting the facts about its effects on radio equipment is difficult. We read in some places that solid-state equipment can be expected to destruct anywhere within hundreds of miles of a blast. Then we read that, hell, all you have to do is wrap things in foil to protect them. Truth probably lies somewhere in between, though more toward ease of destruction than ease of protection. Since it looks as if the government is going to be looking to amateur radio for communications when all else fails, we're going to do our best to get the most accurate information on the subject we can, despite cloaks of secrecy which seem to be thrown up around the subject. We really have to know if we are going to do the job.

When defectors brought us the latest in Soviet fighter planes, our technical people had a merry laugh over the primitiveness of the communications equipment. Imagine being so far in antiquity that they are still using tubes! Golly and har de har har.

The smug chuckles turned sour when someone got to thinking about it and ran some tests. Sure enough, tube gear is able to survive surprisingly large blasts of EMP and still come out working fine. Thus it appears that it is getting time to go back to the old workbench and re-invent tube radios and anything else we want to be usable after a nuclear blast in space.

The transistor came just at the time when we were starting to seriously design truly miniature tubes. Oh, we had some small tubes designed for wartime pocket spy radios and for hearing-aid amplifiers. We made some small "acorn" tubes for VHF purposes such as the 955-9 series. Those came along in the 40s. By 1960, we had even better VHF tubes in the nuvistor, and then tubes were phased out. Today our miniaturization techniques are such that we probably can design some very small tubes to be used in EMP-safe radios, and perhaps this is something in which the government should invest.

In the meanwhile, the rest of us need to know if there is any way to protect our repeater transmitters and receivers, the control circuits, and even our digital RTTY and computer circuits so they will still be around after a surprise.

If we're going to be limited to tube gear after an attack, the type of communications we will be able to provide is going to be totally different than if we can use digital equipment, which would make it practical for us to develop high-speed automatic relaying anywhere in the country. If any readers have good solid information on this, let's start getting it. Please, no conjecture or guesses.

One of the problems involved in getting hard information on these pulses, beyond the restrictions of secrecy, is the difficulty of simulating them for testing. Indeed, there is no test site yet available which can duplicate the short intense pulse involved. A test site in New Mexico has been able to generate an EMP by discharging 160 billion Watts of power, yet this pulse is probably about one-third of what we can expect from a nuclear blast.

The pulse travels particularly well in space, so it is possible that one or two bombs detonated out there could wipe out most of the synchronous satellites. With an increasing amount of our communications being routed via these birds, this could screw things up substantially. That's why, in making long-range emergency communications plans, alternatives to satellites must be considered and developed.

The January/February issue of *Science 83* magazine had an article covering the subject if you want more details.

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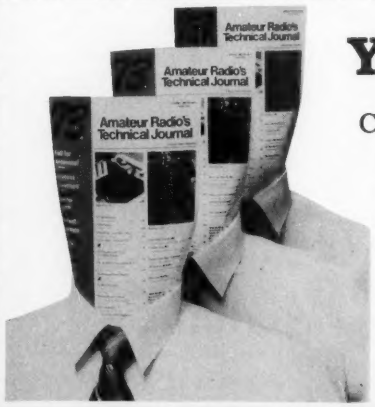

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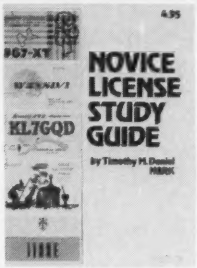

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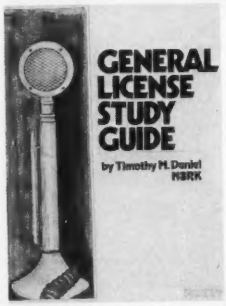

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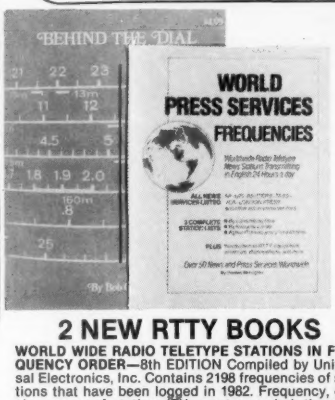

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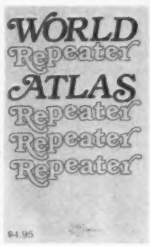

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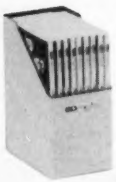

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REVIEW

THE AUTEK RESEARCH QF-1A FILTER

Although many active filter designs pass themselves off as "multi-mode" filters, as being equally useful on phone as on CW, very few end up seeing much use in the shack of a dedicated phone operator. One of the few exceptions to this rule is the Autek Research QF-1A filter.

The Autek filter is an active audio filter combining several functions into one package for use in a variety of signal situations. The two-chip filter with built-in LM380 amplifier is capable of driving either a speaker or headphones of any impedance, and it runs on 115 V ac. Two notch filters, a peak filter, and both low- and high-pass filtering is available. And if you like knob-finding, this peripheral device is for you.

Learning to operate the QF-1A is a little like learning how to drive a car with standard shift. All of the controls interact, and like the grinding of gears when you shift without clutching, the ringing in your ears lets you know when you have made incompatible adjustments on the filter. However, the principle behind the QF-1A is simple—it helps you rid the received signal of unwanted components and enhances the remaining desired frequencies. The complexity is necessary to accommodate the wide range of situations found in amateur operating. For CW work, a very narrow bandwidth is desirable, but a wider passband is necessary for SSB. Meanwhile, interfering noise varies from a carrier raging unbridled 2 kHz up from your frequency to the irritating splatter from the back door of kilowatt alley.

Knob Management

In the hierarchy of controls on the filter, the Function Select Switch reigns supreme. This knob allows you to choose between the aforementioned modes of filtering. Peak and notch filtering have opposite effects; the former passes a narrow range of frequencies and rejects the rest, while notch filtering culls out a narrow range and passes the rest. High-pass and low-pass filters remove frequencies from opposite ends of the audio range.

Two of the three remaining controls have different effects depending on the position of the function switch. The Selectivity control determines the bandswitch of the filter while using the peak filter, and it controls the width of the notch when you are in that mode. Peak bandwidth ranges from 14 Hz at a 300-Hz center frequency to 20 Hz at 800 Hz. On the other hand, greater notch selectivity makes the notch shallower and therefore harder to tune.

The center frequency of both the notch and the peak is determined by the Frequency control, which has a range of 250 Hz to 2500 Hz. In operation, it is important to remember that low-frequency filtering creates a narrow passband in the peak filter and varies the signal components rejected by the low- and high-pass filters.

The final control on the QF-1A is the Auxiliary Notch control. This secondary filter is a wide and deep notch, and the control varies the notch's center frequency from 80 to 1100 Hz.

The Bottom Line

But lest you get wrapped up in all this theory of operation, the bottom line in using the filter is how the signal sounds—and in reaching this objective, anything goes. When using the filter, you are in a double bind of trying to bring a signal out of the mud and trying to keep track of it while the filter changes the signal's quality. Expect some frustration at first, because finding the correct settings requires a practiced ear.

The filter is most effective working against carriers near your frequency. The deep notch can be set on the carrier quickly, and then you can adjust the width to keep other components of the signal. Filtering a nearby voice station is more difficult because a voice signal contains a wider range of frequencies, making it difficult to mask. When attempting to blank another voice station, you may have to settle for simply enhancing the desired signal with the peak filter and ridding the interfering signal of its more irritating qualities.

Splatter is another problematic situation when using the filter; at times there was little I could do, and at other times I could reduce the splatter to a minimum level. Although I did not test the filter in conjunction with SSTV or RTTY transmissions, these are two other areas where the qualities of the QF-1A could be used to their maximum potential.

One of the benefits of using the filter is its built-in amplifier. Whether or not you can clear away flotsam from another signal, the amplifier will help improve the presence of the signal.

Autek includes a full-page table to help get you started with the filter. The table is divided into common interference problems and suggests settings for the controls. These are good starting points, and until you develop an ear for the filter and its controls, it will be necessary to consult the table.

Also included in the manual are alignment instructions and troubleshooting hints, although these units have proved to be extremely sturdy and require little maintenance.

Wrap-Up

I have been very pleased with the QF-1A and its ability to clean up voice as well as CW signals. Several times, I have been forced to use it in deteriorating band conditions, and it made QSOs possible when there would otherwise have been just noise. I also found myself using it with strong stations, not only to clean up the signal but also to put more fidelity in my reception. The filter gives you the opportunity to rearrange the other person's voice to suit the temperament of your receiver and your ears.

The ability to flip the filter in and out with a front-panel switch also proved to be a boon, as I did not have to reach around to the dark end of my transceiver to move it quickly into play. The filter also comes with a full year's warranty for both the components and construction, which is good in comparison to the 90 days other companies provide. After the warranty period, there is a minimum $15 service charge, but I doubt if you will have to take advantage of it.

For further information, contact *Autek Research, Box 302, Odessa FL 33556.*

Avery L. Jenkins WB8JLG
73 Staff

The Autek Research multi-mode filter.

KENWOOD'S PANADAPTER

I was more than excited to walk into the W2NSD/1 shack and see the Kenwood SM-220 Panadapter on the bench. My first thought was that it sure is nice to work for a company that is "in the business."

"This is one of those station accessories that looks nice but really couldn't improve my operation," I thought to myself.

Boy, was I wrong! After only a few minutes of reading the documentation, I was learning more about the band and station signals than I could ever tell from my "experienced" ear. I soon learned that the SM-220 was a lot more than just a monitor for my transmitted signals. The real beauty of this device is its ability to put into a graphic display the signals that you are receiving.

The SM-220 has several standard functions. Number 1 is its ability to function as a monitor scope. This allows you to display your transmitted waveform from 1.8 to 150 MHz (with some power limitations in the upper VHF range). This function allows you to "see" instantly the signal that you are transmitting. If you are on CW, you can view the keyed waveform and watch for anything from dirty key contacts to too soft a signal. In SSB, you can monitor your signal for the "ideal" waveform or watch your signal deteriorate from excessive audio drive.

Also built into the SM-220 is a two-tone generator and ample diagrams to discern between the "ideal" waveform and one from an overdriven transmitter or defective ALC. All the aforementioned functions are for your transmitted signal. The real kick from operating this scope is watching other signals on the band.

For those of you who are Teletype® operators, the SM-220 displays the standard RTTY cross pattern for tuning in other stations. In addition to telling you if you are tuned to their frequency (sure beats a tuning meter), it will tell you if their space or mark frequencies are exact and if your demodulator or TU has low Q.

The pan-display option (well worth the extra cost) is probably the best feature of the whole unit. It is a plug-in and requires no soldering to install. We have all heard the old-timers refer to panadapters fondly. Now I know why! It is a great feature, and I'll tell you why. Just imagine trying to make that sked you and your buddy try (but not so faithfully keep) on 20 meters. You finally make contact with him and a station comes on your pre-established frequency and tells you that you are QRMing a QSO or net already in progress. Instead of telling your friend "stand by and I'll look for a clear frequency," or "up 5" until you are in the 10-GHz range, all you have to do is look at your SM-220 and immediately see where the "hole" in the band is. It's a fantastic feature! The pan-display option allows you to look at either +/– 20 kHz from your received frequency. You can determine if there is a carrier up 10 kHz or an SSB station 3 kHz away. Not only can you see these signals, but you can also tell their relative signal strengths.

And after a short time operating the SM-220, you can develop a fairly accurate correlation between the vertical size of the signal on the scope and the actual signal strength as recorded on your receiver's S-meter. Just think of the ease of operation if you are a contester or even a casual DXer. When the desired station says "listening 14.200 to 14.300," you can look at the display and put your transmitter right into a clear spot.

On top of all of the above features, and an excellent instruction manual (complete with schematics), the SM-220 is a standard 10-MHz oscilloscope. As I said to Jeff DeTray WB8BTH as he walked into the shack with lunch, "I want one."

For additional information, contact *Trio-Kenwood Communications, 1111 West Walnut Street, Compton CA 90220.*

Bob Cunningham K1XR
73 Staff

THE YAESU FT-102

Just as the day of the completely homebrewed station has passed, the era of the single-purpose rig has become history. Where once a ham might have had his CW rig for one band and a phone rig for another, today those functions have been integrated into one package. And as technology progresses, more and more functions can be squeezed in.

The Yaesu FT-102 is a perfect example of just how multi-modal today's radios are. This new Yaesu has more modes and filters than Elmer had crystals, which makes it useful for the average ham—the one who sometimes contests (but doesn't necessarily win), sometimes DXes (but isn't on the DXCC Honor Roll), and who exclusively works neither CW nor phone.

Standard features on the Yaesu include

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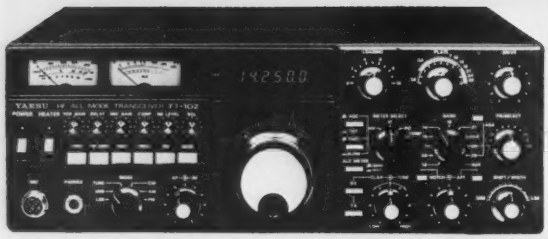
Not bad, eh? Optional additions to the rig feature AM as well as 10-meter FM, SSB and CW filters, and an external vfo with push-button frequency input and 12 memories. And the matching speaker possesses two more audio filters for last-minute signal reception clean-up.

All of the WARC bands have been included on the transceiver, which belts 240 Watts into the finals on SSB and CW below 25 MHz and 160 Watts above. With the AM/FM option, the rig has a final input power of 80 Watts on AM and 120 Watts on FM. Frequency is, of course, PLL synthesized, and the audio quality of the transmitter may be tailored for the best intelligibility with your voice.

One of the most obvious features on the front panel of the FT-102 is the series of inset silver knobs just below the dual meters. These knobs operate the lesser-used controls such as the VOX, microphone gain, squelch, and speech compression. The knobs pop in and out so that once set, they are out of the way and will not be inadvertently readjusted. Just below the miniature controls are a series of switches which turn on the rf amplifier, noise blanker, and speech processor, and switch the crystal filters into the circuit. Standard af/rf gain controls are provided as are the agc (fast and slow) and the receive preselector.

A surprising addition is the tone and clarity control, a feature too often overlooked by most other manufacturers. Nobody has ever claimed that ham radio is a hobby for audiophiles, but after four hours of 20-meter cacophony or the crashing of 80 meters in the summer, my ears appreciate the small comfort a control like this offers.



Yaesu's multi-mode FT-102.

Receiving

When I first turned the transceiver on, I thought it was one of the worst-sounding receivers I had ever heard. 14.32 MHz sounded like a thunderstorm in the middle of a drag race, and only the strongest signals could be pulled in with any intelligibility.

That was before I caught the note in the manual which instructs you to turn the rf amplifier off in noisy band conditions. Chalk one up for reading the instructions first. With the amp off, signals became much clearer, but the receiver still possessed fine sensitivity. As I tuned around the band, one of the first things I noticed was the sharpness of the tuning—and this was before the filters were pressed into service. Unlike some other radios, the frequency readout is no more accurate than the selectivity of the front end—what you see is what you get.

As I gained more confidence in manipulating the basic controls, I began trying out the special features. The SSB crystal filter was easy to use and it enhanced selectivity. However, signals were more difficult to tune in because of the resulting sharpness. More difficult to learn were the i-f shift and bandwidth controls. These controls, located on two friction-coupled knobs at the lower left of the front panel, allow you to select the best bandwidth for the band conditons. Width, of course, narrows the passband of the i-f and it is possible to reduce the adjacent QRM without losing too much of your desired signal. Once the width has been set, then you can vary the center frequency of the i-f to focus on the signal. Although extremely useful, I am at a loss as to why Yaesu splined the two together, making two-handed operation a necessity.

When using these controls, be ready to adjust your ears to the changing sound. Together, the two controls have enough range to render unintelligible a previously clear signal.

The peak and notch controls add another level of reception manipulation, this time in the audio portion. These filters are less powerful than the i-f controls and are useful in the less strenuous conditions. Although I do not know if the engineers who designed the FT-102 intended the peak and notch filters to be used in this way, I found that they conditioned the sound to be more pleasing if not necessarily less polluted.

Overall, I found the receiver quality to be one of the best I have encountered. The toughest part of using the receiver is hanging on to a weak signal until you can get all of the controls peaked. While trying to eliminate adjacent QRM, it is easy to mask the signal you want because of the interactive characteristic of the controls. I learned this the hard way in a QSO with a Topeka station who mysteriously disappeared. I thought it was severe QSB working in hand with QRM until I realized that I had put the i-f shift on the wrong side of the signal.

Transmitting

From all reports, the FT-102 has excellent audio, due in part to the adjustments which can be made to tailor the transmitter to your voice. The first step is to cut in the monitor switch to hear your audio as others hear you. Two controls, accessible through the bottom of the rig, adjust high- and low-frequency attenuation. These are set-and-forget controls which need no adjustment unless you start using a different microphone or sell the rig.

The monitor function can also be used to help set the compression on the speech processor and avoid the negative effects of over-compression which void the gain derived from processing. It's no use getting an extra 5 dB if the person on the other end can't understand what you are saying. Short of having another ham tape your transmission and play it back or using an oscilloscope, there is no better way to get your outgoing signal the way you want it. The monitor latches onto the audio in the transmitter i-f so that you get a true indication of quality rather than just amplification of the microphone input.

Another useful transmitting feature is the ALC "peak hold" circuitry. The ALC meter will hold your voice peak for approximately one second to make accurate adjustment of the mike gain control exceedingly easy.

Transmitter tune-up is a variation on the standard drive-plate-loading theme. Instead of varying the plate and loading controls simultaneously for a meter peak, the Yaesu manual recommends moving the load control up in discrete steps and adjusting the plate control until you reach a specified level on the meter.

CW fanatics will be glad to know that they can adjust the pitch of the CW sidetone to suit their taste. The FT-102 provides semi-break in, with the VOX delay controlling T-R switching. Alternatively, the front-panel MOX switch may be used or an outboard switch may be connected to the rear-panel PTT jack. In addition, the instructions for the Yaesu include a section on how to squeeze as much juice as possible from the transmitter when operating on CW.

Accessories

Most notable among the accessories for the FT-102 is the FV-102DM external vfo. Set in a matching cabinet, the vfo expands on the capabilities of the digital circuitry of the transceiver.

The FV-102DM's five-digit display displays kilohertz with a resolution to 10 Hz, and it may be tuned with the tuning knob or by using the built-in keyboard. Scanning speed may be adjusted or you can enter a frequency directly on the readout to move instantaneously to another frequency. The keyboard also offers a stepping rate of ±20 kHz or ±5 kHz, and both the keyboard and the tuning knob may be disabled when operating from the frequency memory bank.

Four tuning rates may also be selected for the analog control, and any of these rates may be multiplied by a factor of 10 for super-fast tuning. A series of switches allows you to put the receiver and transmitter on your choice of vfos or place either under the control of the stored frequencies.

A second accessory, the speaker/filter combination, offers the final word in signal conditioning. The two filters used jointly can create a speaker response suited to any environment. You can attenuate highs or lows as well as choose your bandpass width. The speaker itself has been designed for communications responsiveness, and even without the filters the sound is exceptionally sharp and clear.

Finally, the manuals which accompany both the FT-102 and the accessories have been well designed. They include clear and concise operating instructions in addition to tables which outline common control positions for a variety of situations. I am also happy to report that both have extensive theory-of-operation and service sections. Although the sections are certainly far from being comprehensive service manuals, they do cover most of the maintenance and troubleshooting procedures that the average ham would need to keep operating at peak capacity.

Although some would question the need for all of the options which the FT-102 and its accompanying peripherals present, I consider them welcome additions to the shack. Good operating requires access to a variety of techniques, whether you are running a phone patch or chasing DX, and this transceiver offers the necessary flexibility for successful hamming.

For further information, contact *Yaesu Electronics Corporation, 6851 Walthall Way, Paramount CA 90723; (213)-633-4007.* Reader Service number 492.

Avery L. Jenkins WB8JLG
73 Staff

HEIL HC-3 MICROPHONE CARTRIDGE

Bob Heil, 1982 Radio Amateur of the Year, never stops moving. He has more irons in the fire than any other ten people, and most of them are deeply involved with audio and amateur radio. Since 1966, Bob Heil has been a sound manager on the road with such groups as The Grateful Dead, The Who, Dolly Parton, Billy Graham, and many others. He has wide experience with radio- and TV-broadcasting studio audio systems and has written many books on the subject of good audio, including *A Practical Guide for Concert Sound.*

Long ago, Bob discovered that speech intelligibility is a function of clean audio—audio that is not cluttered with distortion. Distortion comes from intermodulation products caused by the combination of audio frequencies whose fundamentals may be below the audible range...say at 50 to 200 Hz. These will pile up on one another and produce combination frequencies that are within the audible range... hence distortion. The effect of this low-frequency rumble is to render the audio less intelligible and "muddier." In addition, as you tune across an SSB signal, it often is heard a long way from the center frequency because of these intermodulation distortion products. A good, clean SSB signal is more sharply defined, and the low and high cutoff frequencies are closer together. The voice sounds more natural...almost as if the person were present in the room with the listener.

Bob is a believer in the fact that good, properly designed and executed speech can be heard over the caterwauling of a DX pileup, just as a singer can be heard over 120 dB of drums and guitar...provided the right things are done. The right things have to do with articulation and sibilants. Articulation is the ability of the mind to hear and clearly understand what is being articulated from a source...such as a transmitting station. Sibilant sounds—s and t sounds—are necessary for intelligibility...and they must be reproduced faithfully; otherwise, grass sounds like grapf, and callsigns become greatly confused.

Bob and his engineers found that there is another quality called balance, which means that there must be a balance between the audio frequencies between 1200 and 1500 Hz, and those at the bottom and top ends of the speech range. The critical frequencies for sibilants and articulated syllables lie in that range...and the microphone or audio system must produce exactly the right level of these frequencies as clearly and cleanly as possible, i.e., without distortion and properly balanced with respect to the rest of the spectrum.

Unfortunately, many hams falsely equate lots of bass response with good audio. While bass is important, it is not everything.

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The goal should be to make the transmitted voice sound as natural and as close to the original as possible.

The HC-3 microphone element ($19.95) does just that . . . it reproduces the natural voice as closely as possible to the original by giving proper emphasis and balance to the sibilant range without neglecting the highs and lows. It rolls off rapidly below about 450 Hz and above 2,400 Hz and is designed as a replacement element for almost any amateur microphone.

In my case, I substituted my faithful old Shure 444 dynamic element with the HC-3. The first thing I noticed was that the output level of the HC-3 was not quite up to that of the 444. Bob Heil explained that this was so because the necessary fidelity and frequency balance could not be obtained with high output. The development engineers produced the best possible trade-off between output and articulation for the desired audio quality. The level was taken care of by merely increasing the microphone gain until the output level for the transmitter was correct once more.

I enjoyed SSB contacts on 160 meters, 40 meters, and 20 meters using the Heil element. Most reports were unsolicited, although I did ask several stations to give me critical reports. The consensus was that the HC-3 produced clear, natural-sounding audio that was very crisp and easy to tune. Several stations commented on the sharp tuning of my signal, and complete absence of splatter or distortion. Most of them mentioned that my voice sounded as real as if I were in the same room . . . and they imagined that it must sound exactly like me. Others commented about the "presence," which I took to mean some sort of attention-getting quality or "authority."

In general, the reports were uniformly and unanimously favorable. Since those tests with my Astro 102BX, I removed the HC-3 cartridge from my 444 and replaced the original element. The cartridge was then loaned to Avery Jenkins WB8JLG to play with and use on his own rig in order to see what effect it would have on audio quality and reports. Avery's report:

"My initial reaction as I installed the new Heil cartridge into my microphone was that things sure have gotten smaller since the people at Turner put the finishing touches on my old single-sideband special. Where the original microphone took up the full diameter of the grill—about 1½ inches—the Heil cartridge is about the size of my thumbnail. The size differential was so great between the two components that I had to tape the Heil cartridge to the inside of the grill so it would not just flop around in there. The instructions supplied with the cartridge note that mechanical shock is not healthy for the cartridge, so I surrounded it with foam cushion, although I was not sure what effect the padding would have on my audio.

"I need not have worried; all of the reports received pronounced my audio as healthy. Although I cannot vouch for any gain in my signal strength, I suspect that the cartridge made some effect in marginal signal conditions, particularly when fighting heavy QRM. It is at those times when your audio needs that added presence to distinguish it from all of the other signals coming through the speaker at the other end.

"The audio from your signal encounters many adversities on the way to its destination, so, it makes sense that you would want it to be as clean as possible from the start. And if you are processing your audio, intelligibility becomes even more of a factor as you give some of it up for the added punch of compression.

"One of the more common problems with amateur-station audio is an excessive bass component, a result of both the transmitted audio and the audio response of the receiver and its speaker. With my Turner, this was a problem, so I asked my contacts on 15 meters to give me an honest rating of my voice as they heard it.

"None felt that the signal was too bassy. Some of the stations that I was getting a good signal into also noted an interesting effect; they suggested that I sounded similar to other stations using a linear—apparently, the audio had the kind of power normally associated with a kilowatt or more.

"Those comments are the kind I like to hear. Although the Heil cartridge may not give you the raw strength of a linear, it does rectify one of the more commonly overlooked problems in amateur operating—intelligibility. And in many cases, it is a basic factor like this that can make or break a successful QSO."

For more information, contact *Heil Sound, Ltd., Heil Drive, Marissa IL 62257; (618)-295-3000.* Reader Service number 489.

Jim Gray W1XU
73 Staff

The Moscow Muffler.

AEA'S MOSCOW MUFFLER™ WOODPECKER BLANKER

There are few hams, indeed, who have not been annoyed, enraged, disappointed, frustrated, and driven to blind fury by the Russian OTH radar whose rat-tat-tat-tat-tat pulses have disrupted amateur communications for the past five years or so. The woodpecker has shown up on frequencies below 30 MHz almost at random, except that—more often than not—it stays very close to the MUF . . . and irregularly changes frequency by hundreds of kilohertz . . . up and down the bands where DX communications are the best at any given time. We've all had weak stations obliterated just as something interesting was about to be said, and we've even lost rare ones now and then because of the dratted woodpecker.

From time to time, articles describing blankers that purport to deal with these pulses have appeared in the ham literature, and some of the blankers have been successful. Virtually all have been designed for use in a receiver only, and a few of them have been designed for only one type of receiver circuit. None has been available in ready-made form (as far as the writer knows), with the exception of some very recent equipment whose built-in noise blankers have incorporated variable pulse width and repetition-rate blanking. These—sometimes—effectively get rid of the noise. Most only reduce it from impossible to barely acceptable.

What has been needed is a pulse blanker that will absolutely eliminate the pulses, a blanker that can be used with a transceiver or a receiver, and one that is readily available for anyone at a reasonable price. Until now, that need has not been met.

At the Boxboro Hamfest last fall, Advanced Electronic Applications showed up with the prototype Moscow Muffler™, an affordable and easily-employed woodpecker blanker that could be inserted into the coaxial cable between rig and antenna, which would wipe out the woodpecker with only a few simple adjustments. It was an instant success, not to mention a mild sensation. The demonstration allowed one to knock the pulses down from an S9 + 20-dB level to less than about S2 on the test receiver.

Naturally, it wasn't long after the demonstration that we asked for a unit to test . . . and it wasn't very long after that that the WB-1C showed up on our doorstep—that is, the doorstep of the W2NSD/1 ham shack. Good-bye to frustration and anger, and hello to living with the Russkis' efforts to drive the West bonkers. Come to think of it, I'll bet a few UAs don't like it, either.

Description

There are two models available: the WB-1 and the WB-1C. Either one will interface successfully with any communications *receiver* by placing the blanker between the antenna and the receiver antenna-input terminal. Usually, this is done by means of a short length of coaxial "patch" cable with PL-259 UHF-type plugs at each end to mate with the SO-239 chassis connectors.

The WB-1C model, however, is intended for use with a *transceiver* in which the output power is less than (or can be reduced below) 150 Watts. No internal modifications or changes of any kind are required with either model woodpecker blanker, but the transceiver model has an automatic antenna relay that is actuated by sensing rf power in the transmission line and disconnects the delicate circuitry from the outgoing rf during the transmit cycle.

The woodpecker blanker lives in a black box measuring about 6" wide × 5" deep × 2" high. An attractively-screened front panel contains an on-off indicator (LED) plus an on-off power switch (you must furnish your own source of 12 volts dc or buy the available accessory ac/dc converter available from AEA). Next to the power push-button is a gain push-button that allows you to select an internal 6-dB amplifier for bringing up those weak, hard-to-copy signals. Next to that is the blanker on/standby button, and next to that is the rate-selector button offering a 10-Hz or a 16-Hz repetition rate. Two knobs are provided for varying pulse width and pulse sync.

On the rear panel, you'll see the power-input jack, the *antenna* and *transceiver* (receiver) connectors, and a ground terminal. Also, there is a carrier-operated-relay adjustment (COR ADJ) shaft with screwdriver slot. This permits you to adjust the drop-in/drop-out relay timing so that the antenna is disconnected from the receiver for only as long as necessary during the transmit/receive cycle. The box weighs about 2 pounds and looks mighty nice sitting next to the transceiver. Let's see how it works.

Operation

WARNING! Do not connect your transceiver output to the "antenna" connector; connect it, instead, to the "transceiver" connector. Doing otherwise will ruin the unit and void the warranty.

After connecting the antenna to the antenna terminal of the WB-1C and a patch cord between the transceiver terminal of the WB-1C and your transceiver output, connect the 12-V-dc source. The AEA AC-1 wall adapter will furnish the needed voltage and 575-mA current (center-pin positive). Ground the terminal marked ground to your station ground.

Turn on your transceiver, and if it has its own noise blanker, make sure that it is off. Note that no signal will reach your receiver until you turn the power switch ON (if you have the WB-1 receive-only model). With the WB-1C, you will hear signals immediately. You may now select the wideband preamplifier, if you like, to bring up the level of weak signals above 14 MHz or so. Frankly, I did not need the preamp, but tried it anyway. It works . . . but more about that later.

When the woodpecker appears, depress the BLANKER button and select the 10-Hz rep rate with the button next to it. Advance the WIDTH control to approximately the 2 o'clock position and slowly tune the SYNC control knob until the woodpecker signal disappears or is much reduced in level. Then, slowly reduce the blanking pulse width by rotating the control counterclockwise, and fine-tune the SYNC control. I found the 10 o'clock position to be about right for WIDTH. Excessive width causes more loss of signal than necessary.

Special Condition

The woodpecker apparently transmits from at least two locations: one in Siberian Russia and the other in European Russia. You will find that in most cases you can adjust the blanking to reduce pulse amplitude by 45 to 50 dB. If it's less, this could be due to poor adjustment, but more likely to multiple-path propagation where the delay or phase lag causes your SYNC control to lock on the primary pulses but not the delayed or out-of-phase ones. Perhaps lack of synchronizing could be due to both woodpeckers jamming at once. Incidentally, the woodpecker sometimes operates at a 16-Hz rate, so it might be wise to try that if you don't get all the pulses at 10 Hz. In my case, I did not need the 16-Hz rate, as every time I heard the woodpecker it was using 10-Hz pulses.

Since I operate mostly CW, I was anxious to find out how much of the incoming signal I was going to lose because of the blanking. (Remember, "blanking" means

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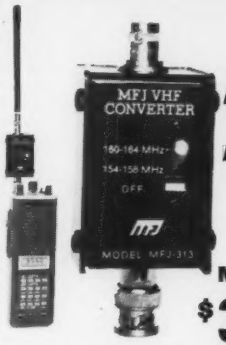

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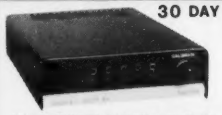

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just that...it knocks out a portion of the received signal in lock-step with the woodpecker. You actually are listening to "nothing" with each pulse blanked out.) At some Morse speeds, parts of the characters are lost, but an adjustment of sending speed will help. The blanking action bothers CW more than phone.

Sometimes the synchronizing may be difficult. If so, try changing the agc control of your receiver from slow to fast, or vice versa. If that doesn't help, turn the blanker OFF and ON again quickly.

Other Comments

I have a wideband, low-Q, multiband vertical antenna system that allows me to operate on the ham bands of 10, 15, 20, and 40 meters. When I tried this antenna with the preamplifier ON, I was assaulted by commercial signals from some other band—possibly forty meters—when listening to the 20-meter band. This was the result of some signal being picked up and amplified by the WB-1C preamplifier. It disappeared when I switched off the preamp. It also disappeared when I changed to a single-band antenna or when I tuned on another band.

I was worried about the problem, so I called Mike Lamb at AEA. He said that he had another report of a similar problem, and found it was due to the presence of a very strong local FM station close to the QTH of the person who complained. This also turned out to be the case in my QTH. Mike's suggestion of a low-pass filter between the antenna and the WB-1C solved the problem by trapping out the high-level energy in the 88-108-MHz region that was mixing with desired signals and amplified by the on-board preamp.

It turns out that I don't have the problem now because the addition of the low-pass filter solved it. If necessary, I could have turned the preamp OFF and solved it, too, but I did want to be able to boost low-level signals on rare occasions.

The use of an antenna tuned to the band you are on and no other band also will reduce the problem greatly. However, spurious response is likely to be a problem only in those rare cases where you have a strong, local, interfering signal from a commercial station and choose to use the preamp without using a low-pass filter in the circuit.

The Blanker and You

Will you like it or hate it? If you suffer from the ravages of the wild woodpecker, you are likely to love it. You will note that it takes some adjustment to make it work properly, and—like everything else—experience and practice pay off. I can't foresee anyone who will hate it. In the case of someone who never operates where the woodpecker is found...he won't need the WB-1 or WB-1C anyway (lucky soul). For the rest of us poor, suffering hams, the AEA Moscow Muffler is nothing short of a boon and a delight. The WB-1C is worth every penny of the $149.95 price ($129.95 for the WB-1), and—best of all—it will kill the woodpecker *DEAD!* The AC-1 is $14.95. For more information, contact *Advanced Electronic Applications, Box C2160, Lynnwood WA 98036.* Reader Service number 490.

Jim Gray W1XU
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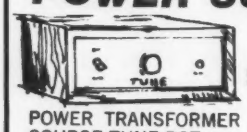

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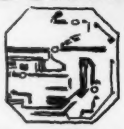

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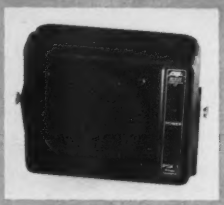

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The PSK-1 is housed in an attractive case that would also decorate any base station. Power can be obtained from any 12 VDC source capable of 500 mA.

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✓See List of Advertisers on page 114

NEW PRODUCTS

SLINKY DIPOLE TUNING CHART

The Blacksburg Group has announced that it has the information necessary for tuning up the Slinky Dipole on the new 10-MHz band. The antenna needs no attachments for use on this frequency, but it does require an additional tuning chart.

The company is offering the chart free of charge to all Slinky Dipole owners, regardless of when or from whom they bought the antenna. Slinky Dipole owners should send a large (#10), stamped, addressed envelope to The Blacksburg Group to receive the information. If writing from overseas, you need only send your name, address, and two IRCs.

For more information, contact *The Blacksburg Group, Inc., PO Box 242, Blacksburg VA 24060; (703)-951-9030.* Reader Service number 477.

COM-RAD'S DDRR WITH RANGE EXTENDER

A unique accessory called the Range Extender now offered by Com-Rad Industries can be added to their very successful DDRR two-meter antenna (a DDRR and Range Extender combination is also available for 220 MHz). The Range Extender is a tapered stainless-steel whip and mounting base that can be attached to the end of the ring element of the DDRR. The unique feature is that the DDRR can be used alone or with the Range Extender without retuning. The transceiver sees no change in load. The use of the Range Extender does not, in any way, detract from the DDRR's ability to reject intermod.

Com-Rad's DDRR with Range Extender.

Tuning is accomplished simply by adjusting the stainless-steel capacity disc's height above its ground plane by turning the threaded stud attached to the disc and tightening the wing nut. The disc system supplements the bronze strap that was formally used and reduces the height of the antenna another two inches from its already extremely low profile. Owners of Com-Rad's DDRR antennas with bronze tuning straps may return their units to the factory for conversion to the disc tuning system at a minimal cost. For more information, contact *Com-Rad Industries 1635 West River Parkway, Grand Island NY 14072; (716)-773-1445.* Reader Service number 476.

SATELLITE-TRACKING PACKAGE

Computer Applications has announced Pathfinder II, the new multi-option satellite-tracking package for Apple computers. Pathfinder II has been designed to operate with a minimum of user-supplied information.

This program will track any circular-orbit satellite from anywhere in the world. Tracking is conducted in real time, and the path may be mapped on either a world or US map, using high-resolution graphics. Maps and tables of data may be printed on the Epson MX™ printer.

Pathfinder II comes complete with satellite-tracking information for OSCAR 8, NOAA 6 and 7, and the RS satellite series 3–8 already on disk. Information for other satellites may be added to the program's data base.

In addition to predicting future orbits and reference orbits, the program will compute and present a summary of orbital characteristics, using an exclusive, high-speed, accurate prediction algorithm.

For additional information, contact *Computer Applications, 3628 A Court, Oxnard CA 93033.* Reader Service number 486.

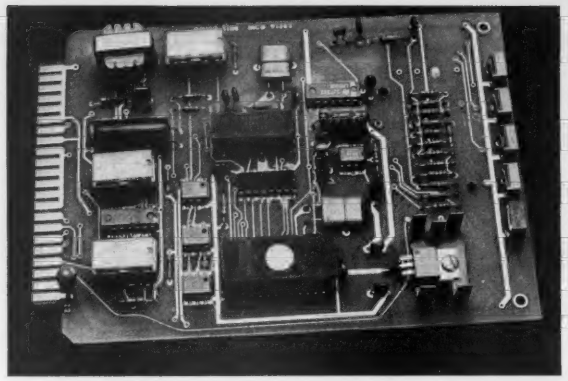
MCD 01 REPEATER CONTROLLER

Micro Concepts and Design Company has released its MCD 01 Repeater Controller, which provides the best quality in repeater control using the highest technology available for controller application.

The MCD 01 utilizes a Motorola MC 68705 microprocessor as the heart of the unit, combined with the latest in programming techniques. The MC 68705 contains 2K of EPROM and 112 bits of usable RAM. The stored program is protected in ROM against loss due to power failures. With this combination, a highly reliable and easy-to-maintain controller can provide a repeater with sophisticated control techniques never before seen at a modest cost.

A single-chip ITT 3201 DTMF decoder is used to decode all 16 touchtones™ used in repeater operation. This gives the repeater owner the capability to use any or all of the 16 DTMF tones. The chip contains both high and low filtering to prevent falsing.

Other features include 4 repeater access modes (carrier, touchtone, touchtone or PL, and PL only) and 3 autopatch/autodial access modes. The autopatch feature includes both touchtone and rotary dial capability. You may use any number of digits for any control or access command, and telephone line or auxiliary receiver inputs may be used for control purposes without disturbing normal repeater operation. The functions may be disabled together or separately.



The MCD 01 Repeater Controller.

A programmable subaudible tone encoder/decoder with 32-tone capability is included in the control unit. The encoder/decoder contains the necessary audio filters for the tones.

The primary design concept in the MCD 01 is to provide needed and practical features with complete operator control and easy-to-maintain circuitry. All components used in the controller are easy to obtain, and they have been mounted on a high-quality double-sided PC board with a 22-pin edge connector.

The MCD 01's compact size, high-quality components, and fine technology make it a perfect repeater controller for the discriminating repeater owner/operator.

For further information, contact *Micro Concepts and Design Co., PO Box 19786, Orlando FL 32814; (305)-298-3026.* Reader Service number 487.

MFJ-1220 RTTY/CW COMPUTER INTERFACE

The new MFJ-1220 RTTY/CW Computer Interface is a terminal unit that provides TTL/CMOS and RS-232 levels for computer interfacing.

Unlike phase-locked-loop demodulators, this is an optimum design using individually-tuned active bandpass filters. It has separate mark and space channel filters, a CW filter, and a post detection low-pass filter for excellent weak-signal and high-interface RTTY/CW performance.

It takes received RTTY/CW audio from your transceiver, demodulates it, and provides TTL/CMOS and RS-232 levels for interfacing with nearly any computer. A program (not included) is used to provide RTTY/CW text.

For RTTY transmission, your computer drives the AFSK generator to provide FSK transmission using the microphone or phone-patch input of your SSB transmitter, or it can directly key the FSK input of your transmitter.

For CW transmission, your computer drives the high-voltage keying currents of the MFJ-1220 which then provides grid-block or direct keying for your transmitter.

The RTTY/CW Interface transmits and receives all standard RTTY shifts of 170, 425, and 850 Hz to cover all amateur, commercial, and military traffic to over 100 wpm. It uses the standard space tone of 2125 Hz and mark tones of 2295, 2250, and 2975 Hz.

Meter, mark, and space LEDs aid in precision tuning. The mark and space LEDs also indicate mark and space transmissions. A normal/reverse switch reverses the polarity of the mark and space for receiving. A CW transmit LED provides visual indication of CW transmission. A sensitive autostart feature keeps noise from activating the computer or printer when there is no RTTY signal.

The MFJ-1220 operates on 12 V dc or 110 V ac with an optional adapter, the MFJ-1312. The cabinet is eggshell white with walnut grain and top. It measures 10×2×5 inches.

MFJ provides a 30-day money-back trial period. If you are not satisfied, you may return it within 30 days for a full refund (less shipping). MFJ also provides a one-year unconditional guarantee.

For additional information, contact *MFJ Enterprises, Inc., 921 Louisville Road, Starkville MS 39759; (800)-647-1800.* Reader Service number 479.

YAESU HF TRANSCEIVERS

Yaesu Electronics Corporation has announced two additions to its line of HF transceivers.

The FT-980 is a full-featured 160-10-me-

MFJ-1220 RTTY/CW Computer Interface.

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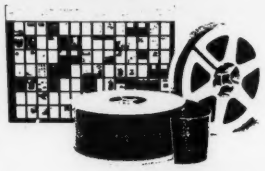

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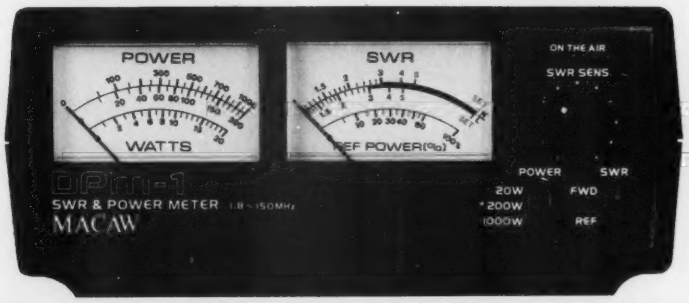

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The Yaesu FT-980 HF transceiver.

The HC-200 antenna tuner from Encomm.

ter transceiver which also includes a general-coverage receiver section. Providing a nominal 100 Watts rf output from a low-distortion, high-voltage final amplifier, the FT-980 is set up for full QSK with silent solid-state switching. The receiver section is designed for wide dynamic range and versatility in filter selection. An audio peak filter, i-f notch filter, variable pulse-width noise blanker, variable i-f bandwidth with i-f shift (passband tuning), and an audio-shaping control round out the receiver features. The FT-980 is controlled by an 8-bit microprocessor, which allows storage of frequency and mode into memory while also allowing the programming of subband limits for Novice-, Technician-, General-, or Advanced-class operators. Direct keyboard entry of frequencies provides instant QSY without the need to rotate the main tuning dial.

The FT-77 is an extremely compact HF transceiver for active mobile or space-conscious operators. Utilizing computer-aided design and automated insertion techniques, the FT-77 represents a new advance in manufacturing efficiency and reliability. Equipped for SSB and CW operation (FM optional), the FT-77 includes digital frequency display, CW wide/narrow selection, selectable agc, RIT, and a highly effective noise blanker.

A full line of accessories is available for both the FT-980 and the FT-77. For further information, contact *Yaesu Electronics Corp., PO Box 49, Paramount CA 90723.* Reader Service number 480.

SATELLITE STEREO PROCESSOR

A new satellite stereo-processing component from Channel Master now gives home TVRO users the capability of full stereo enjoyment of auxiliary audio services carried on the "birds."

The multi-mode stereo processor, model 6140, takes audio subcarrier signals from the satellite receiver and decodes them for use with an ordinary home stereo receiver system. It will also allow monaural audio subcarriers to be heard through hi-fi speakers for added enjoyment of satellite video programming.

Decoding of separate, multiplex, or matrix stereo is accomplished via front-panel, push-button selectors. Two independent tuning controls are provided for selecting the subcarrier channel desired in the range of 5.5 MHz to 8.0 MHz. A selectable i-f filter allows reception of high-fidelity programming with low distortion.

For easy tuning of favorite stations, four independently preset positions may be selected using the PROGRAM switch. Popular subcarrier frequencies have been preprogrammed at the factory on all four of these positions. The TUNE position on this switch allows the selection of alternate subcarriers.

The sleek styling of the Model 6140 Satellite Stereo Processor has been designed to match the look for the industry-acclaimed Channel Master satellite receiver. For more information, contact *Channel Master Division of Avnet, Inc., Ellenville NY 12428; (914)-647-5000.* Reader Service number 484.

ANTENNA TUNERS

Encomm, Inc., has announced two antenna tuners from Tokyo Hy-Power Labs: the HC-2000 and the HC-200.

The HC-2000 is a 2000-Watt PEP (500 Watts maximum on 1.9 MHz) HF antenna coupler with a power/swr meter and a versatile 12-position antenna switch (6 through the tuner and 6 bypass). It will tune coaxial-fed antennas, balanced-line antennas (balun included), or endfed wires. The HC-2000 is bandswitched for the 1.9-, 3.5-, 7-, 10-, 14-, 18-, 21-, 24.5-, and 28-MHz (all WARC) bands, so you don't have to experiment to find your inductor setting, plus it has 6-to-1 vernier dials on the capacitors for easy fine tuning. Scales on the dual meters include swr, 2 kW, 200 W and 20 W. Connectors are SO-239s and Johnson terminals.

The HC-200 is a combined 200-Watt HF antenna coupler with a power/swr meter and a six-position antenna switch (3 coaxial/wire positions through the tuner and 3 bypass). It will tune endfed wires, coax, or balanced-line antennas (with optional balun). The HC-200 is bandswitched for the 3.5-, 7-, 10-, 14-, 18-, 21-, 24.5-, and 28-MHz (includes new WARC) bands. Scales on the meter include swr, 20 W, and 200 W. Connectors are SO-239s and Johnson terminals.

Both antenna tuners have high quality ceramic coil forms, well-damped/well-shielded meter circuits, as well as first-class design and layout and there are no ferrite cores in the main inductor to saturate!

For more information, contact *THL Sales Department, Encomm, Inc., 2000 Ave., G Suite 800, Plano TX 75074; (214)-423-0024.* Reader Service number 481.

DB-GAIN ANTENNAS

DB-Gain Antennas of Ft. Lauderdale, Florida, has announced its new line of antenna products with the introduction of its commercial-grade dB-Gain vertical mobile antenna. Available in 450 and 220 MHz and 2, 6, 10, 15, 20, and 40 meters with a power rating of 250 Watts, these antennas were designed primarily for mobile use, but each can be used in a fixed-station application.

Each dB-Gain antenna whip and set screw is made of 17-7 stainless steel. Heavy-gauge fiberglass (.031 wall/spiral finish) coil housings provide strength and durability for extreme weather conditions. Each coil is wound with no. 16 copper, and the remaining hardware is chrome-plated brass. A standard mounting ferrule of 3/8" ×24 thread is compatible with most mobile mounts.

For additional information, contact *Tom Adams W4MTW, dB-Gain Antennas, 2308 NE 20th Avenue, Ft. Lauderdale FL 33305; (305)-566-2200.* Reader Service number 491.

DATASAVER™ AC POWER BACKUP

The Datasaver ac power backup, available in 90- and 200-Watt capacities, is a battery-powered backup unit which keeps many of the popular computer systems and instruments operating during ac power interruptions or transients. Both versions utilize a precision 0.1-percent crystal frequency standard that allows real-time power sensing and prevents video jitter that affects many computer displays.

The Datasaver provides overvoltage transient suppression and EMI noise filtering. Standard features include rechargeable sealed battery, automatic battery charger, solid-state power inverter, ac line voltage monitor and cutout switch, visual and audible alarms, and remote alarm signal for interrupt-driven computer applications. US and foreign power configurations available.

External battery jacks are provided to allow any 12-volt battery (car, motor home, boat, etc.) to become the power source for computer operation. For more information, contact Dave Dickey at *Cuesta Systems, Inc., 3440 Roberto Court, San Luis Obispo CA 93401; (805)-541-4160.* Reader Service number 478.

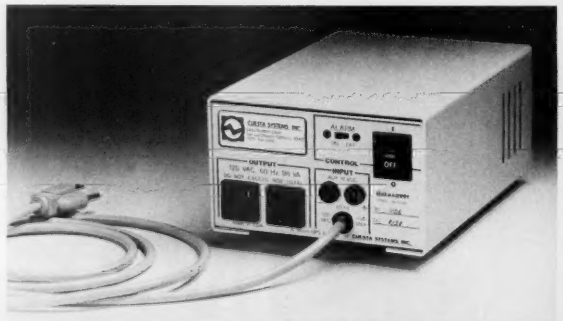
RF WATTMETER

The new Thruline® directional wattmeter expands the usual single full-scale power level of its plug-in element to seven overlapping power ranges.

Tailored for design or field service of CW and FM systems from 200 kHz to 1000 MHz and ¼ Watt to 10,000 Watts, the new precision instrument uses special elements providing seven levels instead of one covering either 1/3/10/30/100/300/1000 Watts or 10/30/100/300/1000/3000/10,000 Watts with ±5% accuracy of reading over a full 37-dB power range. The desired range is instantly selectable by a front-panel rotary switch which also includes a battery-level position. Elements are simply rotated for either forward or reflected power measurement.

Model 4410 Thruline wattmeters feature low insertion vswr of 1.05 or less, temperature compensation to maintain full-rated accuracy from 0° to 50° C, 120% over-

Channel Master Model 6140 Satellite Stereo Processor.



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For more information, contact *Bird Electronic Corporation, 30303 Aurora Road, Cleveland (Solon) OH 44139.* Reader Service number 483.

HS-700 MICROPHONE/HEADSET

MX Products has announced a new lightweight microphone/headset especially designed to complement Icom HF and VHF equipment. The HS-700 features a comfortable, lightweight headset which permits extended operation without operator fatigue and is ideal for contest-style

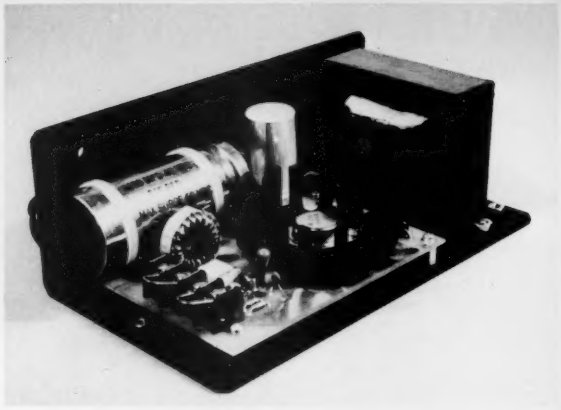
HS-700 microphone/headset from MX Products.

operation. The microphone employs a miniature electret element with integral preamplifier and frequency compensation to enhance intelligibility and "punch." A wind screen is included to minimize wind and breath noise. The microphone boom is adjustable for optimum speaking distance and noise environments. Total system weight is under 4 ounces.

For more information, contact *MX Products, 1152-169th Ct. NE, Redmond WA 98052; (206)-881-0355.* Reader Service number 488.

ADJUSTABLE SWITCHING POWER SUPPLY

Jameco Electronics has added another new model to their growing family of popular power supplies. The JE224 is a high-



Jameco's JE224 power supply.

efficiency power supply which utilizes the LH 1605, one of the latest switching regulators from National Semiconductor that provides high current output and requires only a minimum number of support components to do the job.

The JE224 is adjustable from 4 to 24 V dc and current rated 5 A at 5 V dc, 4.8 A at 6 V dc, 4.1 A at 9 V dc, 3.3 A at 12 V dc, 1.9 A at 18 V dc, and 0.5 A at 24 V dc. Outputs are regulated with over-current protection. The overall size is a very compact 7.75"L × 4.25"W × 2.75"H; and the unit weighs in at only 3.65 pounds.

For more information, contact *Jameco Electronics, 1355 Shoreway Road, Belmont CA 94002; (415)-592-8097.* Reader Service number 482.

DATA FILE MAINTENANCE PROGRAM

Russ Software has introduced Multi-File, its new data file maintenance program for the VIC-20 and Commodore 64 computers. It will work with either cassette or disk storage media, and you can store up to 100 items per file with an unlimited number of files. The VIC-20 version requires the 16K expansion in order to make full use of the program's capabilities; with 3K, files are limited to 20 or 30 items.

The data file program features search and review functions as well as delete, correct, and print data functions. The search function will look for any data on any line of the file; the more specific your input is, the more specific the search will be.

Multi-File will produce audible notification of error messages and the completion of major functions.

For additional information, contact *Russ Software Ltd., PO Box 378, Northwest Station, Chesapeake VA 23322; (804)-421-3914.* Reader Service number 485.

AWARDS

OREGON TRAIL COUNCIL CAMPOREE

On May 20-22, 1983, the Benton District, Oregon Trail Council, Boy Scouts of America, will hold its annual Camporee. This event is a weekend camping experience involving all the scout troops, most of the Cub Scout Webelos dens, and many of the Explorer Posts in the local area.

This year, the Benton District Camporee Committee has invited members of the Oregon State University Amateur Radio Club (K7UYX) to participate in the Camporee as special invited guests. The OSUARC has volunteered to set up an HF demonstration station, provide VHF communications at the camp, and assist the scouts in earning portions of their communications-related scout awards.

Operation will begin at 5:00 pm PDT, May 20, and end at 1:00 pm PDT, May 22. Frequencies are: SSB—3.940 MHz, 7.240 MHz, 14.290 MHz, 21.360 MHz, and 28.990 MHz; CW—3.590 MHz, 7.030 MHz, 14.070 MHz, 21.140 MHz, and 29.190 MHz.

For more information, contact Steve Aberle WA7PTM, 2751 NW Orchard Ave., Corvallis OR 97330.

NANTUCKET EXPEDITION

The Algonquin ARC will activate Nantucket Island, Nantucket County, Massachusetts, May 21-22. Operation will be CW, up 60 from the low end of the bands, and SSB, up 60 from the low end of the General phone bands, 80-10. We will be using the call W1BK. QSL with an SASE via PO Box 258, Marlboro MA 01752.

MT. SAINT HELENS QSO PARTY

The Clark County Amateur Radio Club, W7AIA, is pleased to announce the third annual Mount Saint Helens QSO Party which will be held May 21 and 22, 1983. This QSO party will mark the third anniversary of the cataclysmic explosion of nearby Mt. Saint Helens. This disastrous volcanic eruption took the life of Reid Blackburn KA7AMF who was an active member of this club. Reid was monitoring a USGS observation station near the base of the mountain at the time of the eruption.

Any amateur station making one contact with W7AIA during the two days from 0001 UTC May 21 through 2359 UTC May 22, 1983, will be eligible to apply for the Mt. Saint Helens Award, a beautiful certificate featuring a photograph of the mountain two years after the eruption.

Look for W7AIA on the following frequencies (plus or minus QRM): SSB—3.895, 7.230, 14.280, 21.360, 28.505; CW—3.705, 7.105, 21.105, 28.105; VHF—various Vancouver and Portland area repeaters.

To apply for the award, send log information or QSL card and $2.00 (or 8 IRCs) to: Award Manager, W7AIA, PO Box 1424, Vancouver WA 98668; (206)-693-0033. All proceeds from the award will go to the Reid Blackburn Scholarship Fund which has been established by the Clark County Amateur Radio Club, W7AIA, at Clark College in Vancouver WA.

HAM HELP

I need technical information on the Intercontinental Instruments model TPG-2 double pulse generator. I would also like information on how to reach engineers for Intercontinental, which was located in Farmingdale, Long Island.

Harold May
428 Phillipps
Hinsdale IL 60521

I am offering a $5 reward for the first offer of data which will make my hamfest purchase a functional frequency counter. The PC board contains 7 MAN readouts, 6 74144 chips, and 1 each, 5474, 7440, 7490, 7475, and 7447. There is no clock or input processor. All letters will be answered and all materials returned.

Horace Eddy W2BU
3 N. Belmont
Oneonta NY 13820

I would like information on the positive matched amplifier model PMA-2, made by Jerrold Electronics Corporation of Philadelphia. It looks like a cable TV amplifier. I will pay for any reproduction or mailing costs.

Carl S. Peterson N6CSI
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Chico CA 95927

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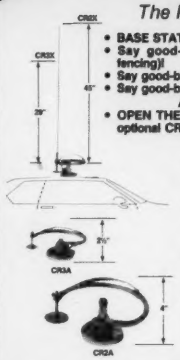

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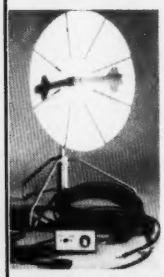

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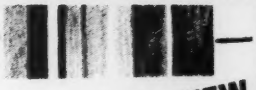

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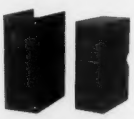

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4511	$2.00
4518	$1.35
5639	$1.75

READOUTS

FND 359 .4" C.C.	$1.00
FND 507/510 .5" C.A.	1.00
MAN 72/HP7730 .33" C.A.	1.00
HP 7851 .43" C.A.	2.00

TRANSISTORS

2N3904 NPN C+F	15/$1.00
2N3906 PNP C+F	15/$1.00
2N4403 PNP C+F	15/$1.00
2N4410 NPN C+F	15/$1.00
2N4916 FET C+F	4/$1.00
2N5401 PNP C+F	5/$1.00
2N6028 C+F	4/$1.00
2N3771 NPN Silicon	$1.50
2N5179 UHF NPN	3/$2.00
Power Tab NPN 40W	3/$1.00
Power Tab PNP 40W	3/1.00
MPF 102/2N5484	$.50
NPN 3904 Type T+R	50/$2.50
PNP 3906 Type T+R	50/$2.50
2N3055	$.80
2N2646 UJT	3/$2.00

TTL

74S00	$ .40
7447	$ .65
7475	$ .50
7490	$ .50
74196	$1.35

SPECIAL

11C90	$15.00
10116	$ 1.25
7208	$17.50
7207A	$ 5.50
7216D	$21.00
7107C	$12.50
5314	$ 2.95
5375AB/G	$ 2.95
7001	$ 6.50

FERRITE BEADS

With info and specs 15/$1.00
6 Hole Balun Beads 5/$1.00

Sockets

8 Pin	10/$2.00
14 Pin	10/$2.00
16 Pin	10/$2.00
24 Pin	4/$2.00
28 Pin	4/$2.00
40 Pin	3/$2.00

Diodes

5.1 V Zener	20/$1.00
1N914 Type	50/$1.00
1KV 2Amp	8/$1.00
100V 1Amp	15/$1.00

25 AMP 100V Bridge **$1.50 each**

Mini-Bridge 50V 1 AMP 2 for $1.00

Resistor Ass't

Assortment of Popular values - ¼ watt. Cut lead for PC mounting, ½" center, ½" leads, bag of 300 or more. **$1.50**

Switches

Mini toggle SPDT **$1.00**
Red Pushbuttons N.O. **3/$1.00**

Earphones

3" leads, 8 ohm, good for small tone speakers, alarm clocks, etc. 5 for $1.00

Mini 8 ohm Speaker

Approx 2¼" diam. Round type for radios, mike etc. **3 for $2.00**

Solid State Buzzers

small buzzer 450 Hz, 86 dB, sound output on 5-12 vdc at 10-30 mA, TTL compatible **$1.50**

Slug Tuned Coils

Small 3/16" Hex Slugs turned coil, 3 turns. 10 for $1.00

AC Outlet

Panel Mount with Leads **4/$1.00**

CAPACITORS

TANTALUM Dipped Epoxy	ALUMINUM Electrolytic	DISK CERAMIC
1.5 uF 25V 3/$1.00	1000 uF 16V Radial $.50	01 16V disk 20/$1.00
1.8 uF 25V 3/$1.00	500 uF 20V Axial $.50	1 16V 15/$1.00
.22 uF 25V 3/$1.00	150 uF 16V Axial 5/$1.00	100 pF 20/$1.00
	10 uF 15V Radial 10/$1.00	047 16V 20/$1.00

DC-DC Converter

+5 vdc input prod. -9 vdc @ 30ma
+9 vdc produces -15 vdc @ 35ma **$1.25**

Ceramic IF Filters... B.W. SOLD OUT ...7 kHz ... $1.50 ea.

25K 20 Turn Trim Pot **$1.00**
1K 20 Turn Trim Pot **$.50**

Trimmer Caps

Sprague - 3-40 pf Stable Polypropylene **.50 ea.**

Crystal Microphone

Small 1" diameter ¼" thick crystal mike cartridge **$.75**

Mini RG-174 Coax **10 ft. for $1.00**

Coax Connector

Chassis mount BNC type **$1.00**

9 Volt Battery Clips

Nice quality clips **5 for $1.00**
¾" Rubber Grommets **10 for $1.00**

Parts Bag

Asst. of chokes, disc caps, tant., resistors, transistors, diodes, MICA caps etc. sm. bag (100 pc) $1.00 lg. bag (300 pc) $2.50

Connectors

6 pin type gold contacts for mA-1003 car clock module price **.75 ea.**

Leds - your choice, please specify

Mini Red, Jumbo Red, High Intensity Red, Illuminator Red **8/$1**
Mini Yellow, Jumbo Yellow, Jumbo Green **6/$1**

Varactors

Motorola MV 2209 30 PF Nominal cap 20-80 PF - Tunable range - **.50 each or 3/$1.00**

Crystals

3.579545 MHZ	$1.50
10.00000 MHZ	$5.00
5.248800 MHZ	$5.00

AC Adapters

Good for clocks, nicad chargers, all 110 VAC plug one end.

8.5 vdc @ 20 mA	$1.00
16 vac @ 160mA	$2.50
12 vac @ 250mA	$3.00

Audio Prescaler

Make high resolution audio measurments, great for musical instrument tuning, PL tones, etc. Multiplies audio UP in frequency, selectable x10 or x100, gives .01 HZ resolution with 1 sec. gate time! High sensitivity of 25 mv, 1 meg input z and built-in filtering gives great performance. Runs on 9V battery, all CMOS.

PS-2 kit **$29.95**
PS-2 wired **$39.95**

600 MHz PRESCALER

Extend the range of your counter to 600 MHz. Works with all counters. Less than 150 mv sensitivity. specify -10 or -100

Wired, tested, PS-1B **$59.95**
Kit, PS-1B **$44.95**

30 Watt 2 mtr PWR AMP

Simple Class C power amp features 8 times power gain. 1 W in for 8 out, 2 W in for 15 out, 4W in for 30 out. Max output of 35 W, incredible value, complete with all parts, less case and T-R relay.

PA-1, 30 W pwr amp kit **$22.95**
TR-1, RF sensed T-R relay kit **6.95**

MRF-238 transistor as used in PA-1 8-10db gain 150 mhz **$11.95**

RF actuated relay senses RF (1W) and closes DPDT relay. For RF sensed T-R relay TR-1 Kit **$6.95**

Power Supply Kit

Complete triple regulated powe... supply provides variable 6 to 18 volts ... 200 ma and +5 at 1 Amp. Excellent loa... regulation, good filtering and sma... size. Less transformers, requires 6.3 ... a 1 A and 24 VCT.
Complete kit, PS-3LT **$6.**

OP-AMP Special

BI-FET LF 13741 - Direct pin for pin 741 ... patible, but 500,000 MEG input z, super low 50 p... SOLD OUT ... power drain.

50 for only **$9.00** 10 for **$2.00**

Regulators

78MG	$1.25	7812	$1.00
79MG	$1.25	7815	$1.00
723	$.50	7905	$1.25
309K	$1.15	7912	$1.25
7805	$1.00	7915	$1.25

Shrink Tubing Nubs

Nice precut pces of shrink size 1" x ¼" shrink to ⅛". Great for splices **50/$1.00**

Mini TO-92 Heat Sinks

Thermalloy Brand **5 for $1.00**
To-220 Heat Sinks **3 for $1.00**

Opto Isolators - 4N28 type **$.50 ea.**
Opto Reflectors - Photo diode + LED **$1.00 ea.**

Molex Pins

Molex already precut in length of 7. Perfect for 14 pin sockets. **20 strips for $1.00**

CDS Photocells

Resistance varies with light, 250 ohms ... over 3 meg **3 for $1.**

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SAVE $$$-QUANTITIES LIMITED!

SONY
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PORTABLE WORLD RECEIVER

"The Best Under $1,000.00...WRTV Handbook

SUPER DEMO PRICE!
$469.95
Plus $8.00 Shipping (Cont'l USA)

List ~~$699.95~~ — Regularly ~~$549.95~~

"DEMO" SPECIAL!
SAVE $80.00 MORE!

We have a limited number of factory demo ICF-6800W's, that are being offered at a saving of $80.00 over the price of new models. These units were used by SONY sales people at Trade Shows, and are still in mint condition. The full 1 year SONY warrantee is also in force. This is a super deal, and is not available from any other dealer in the U.S.A.

ORDER NOW! LIMITED QUANTITY

"easy-talk'r" VOX PORTABLE TRANSCEIVER

$49.95 ea. plus $3.00 shipping

- Up to ½ mile FM Transmitting
- "Hands free" VOX operation
- Light weight—less than 9 Oz.

Valuable aid for Amateur use in antenna installation, tuning/pruning, field day, etc., plus hundreds of applications in home business, sports and recreation. Uses 9 volt battery (not supplied.)

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- Auto Scan • Channel Lockout • "Now Take it With You Anywhere!"

REPEATING 9-MINUTE DROWSE ALARM CAN BE USED FOR STATION I.D. REMINDER

KEN-TEC* 24-HOUR DIGITAL MILITARY TIME ALARM CLOCK

$19.95 PLUS $1.50 UPS

- .7" Red LED Numerals
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- 1-Year Warrantee
- Drowse Control
- Dark Brown Walnut Grain
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SUB-AUDIBLE TONE HEADQUARTERS

ENCODERS $29.95 each plus $2.00 shipping (Cont'l USA only)

We stock **Communications Specialists** SS-32 and SS-32M encoders for most any mobile or hand-held applications including the very popular **Icom Handhelds**.

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Model PLF-2	$52.95
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The Interface™
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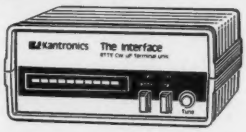
Plus $3.00 Shipping



Your personal computer becomes a complete CW/RTTY/ASCII send and receive terminal with **The Interface** linking it to your transceiver.

If you own an Apple II or Apple II Plus, Atari 400 or 800, TRS-80 Color Computer, or VIC-20, **The Interface** will put your computer "On-The-Air".

Software for each system features split screen display, buffered keyboard, status display, and message ports. Attach any Centronics compatible printer for hard copy. Software is available, on diskette for the Apple and program boards for the others, at additional cost.

Apple diskette	Atari board	VIC-20 board	TRS-80C board
$29.95	$49.95	$49.95	$59.95

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5/8 WAVE TELESCOPING ANTENNA $19.95 Plus $2.00 Shipping Cont'l USA

VoCom POWER POCKET

plus $3.00 shipping (Cont'l USA) $199.95

Accepts any version of the IC 2A, applies its output to a wide band rf amplifier and delivers 25 watts to your mobile antenna. Mobile talk-out power!

2C-025 AMP
$76.50
Plus $3.00 Shipping

- 2 W In
- 25 W Out

SAVE $$$

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Now Only $259.95

SONY ICF-2001 INSTANT-ACCESS DIGITAL SHORTWAVE SCANNER

ADD $5.00 SHIPPING (CONT'L U.S.)

LIMITED QUANTITIES

- AM-CW-SSB
- 150 KHz-30 MHz + FM BROADCAST
- PLL SYNTHESIZED WITH SCANNING AND MEMORY • AC ADAPTOR • 1 YEAR FACTORY LIMITED WARRANTY

B&W PORTABLE APARTMENT ANTENNA

$43.75 plus $2.00 shipping

Quick, easy mounting. Tunes 2, 6, 10, 15, 20 and 40 meter Amateur bands, plus SW BC bands in some ranges. 360 watts SSB/CW. 22½' whip extends to 57'. 14' mount. Includes 5 base loading coils. Weighs less than 2 lbs.

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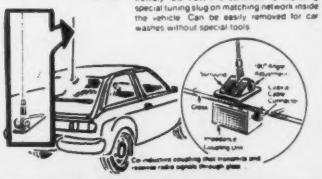
$32.95 plus $3.00 shipping

The Avanti On-Glass is the first two-way communications antenna that mounts on glass and transmits and receives through the glass. Extremely low VSWR is achieved by adjusting special tuning plug on matching network inside the vehicle. Can be easily removed for car washes without special tools.



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SONY 6-BAND
POCKET WORLD RECEIVER

- 6-band pocket world receiver—SW 1-5, plus MW
- Extremely compact and lightweight—palm sized!
- SW band spread dial-easy tuning • Tuning indicator

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500 MAH NICAD

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Fits Wilson Mark II, and Mark IV plus Yaesu FT-207. 500 MAH, 11.7 V. Nickel-Cadmium.

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- Versatile
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FACIT 4555 SERIAL PAGE PRINTER

The Facit 4555 alphanumerical serial printer is complete. Equipped with RS232C Interface, printing mechanism, control electronics, drive electronics, power supply and character generator. The adaptation electronics can be modified in four versions:Bit-parallel data transfer, CCITT (EIA, RS232C) for bit-serial data transfer and the current loop (TTY) interface also for bit serial data transfer. The Facit 4555 prints on ordinary paper and is adjustable for different paper widths and formats, 9.5" paper width with 66 lines per page or DIN A4 with 70 lines per page.

SPECIFICATIONS

Print speed	up to 60ch.s.	Char. spacing	2.54mm/1/10" 80ch/line 1.55mm/0.06" 132ch/line
Printing mode	Incremental.		
Max. # of ch/line	80 alt. 132.	Char. Code	ECMA-6 7-bit coded char. set
Matrix	7 X 5 dot matrix.	Char. Set	63 Char. various national versions.
Char. Size Height	2.7mm/1/8"		
Char. Size Width	1.3mm/0.05" 132ch/line 2.1mm/0.083" 80ch/line	Feed mechanism	Sprocket feed.

THESE UNITS WERE PULLED OUT OF SERVICE IN GOOD WORKING CONDITION. WE CHECK EACH UNIT ON A RADIO SHACK TRS-80 COLOR COMPUTER.

PRINTER ONLY $129.99

Printer with linecord, box of paper, inter-connect cable for TRS-80 COLOR COMPUTER. $149.99

GENEVA CALCULATOR WATCH

This attractive watch has the following modes:
Normal Time Setting,
Calendar Setting,
Daily Alarm Time Setting,
Weekly Alarm Time Setting,
Chronograph,
Calculator.

Featured in Black Plastic $24.99 or Featured in Stainless Steel $29.99

SILICON DIODES

MR751	100vdc	6Amps	10/$5.00	100/$38.00
MR510	1000vdc	3Amps	10/$3.75	100/$24.00
HEP170	1000vdc	2Amps	20/$2.00	100/$15.00
1N3209	100vdc	15Amps	$2.00	10/ $15.00
BYX21/200	200vdc	25Amps	$2.00	10/ $15.00
1N2138A	600vdc	60Amps	$5.00	10/ $40.00
DS85-04C	400vdc	80Amps	$10.00	10/ $80.00
1N3269	600vdc	160Amps	$15.00	10/$120.00
275Z41	300vdc	250Amps	$20.00	10/$175.00
7-5754	300vdc	400Amps	$30.00	10/$250.00
RCD-15	15KVDC	20ma.	$3.00	10/ $20.00
SMFR20K	20KVDC	20ma.	$4.00	10/ $30.00
1N4148	signal		30/$1.00	100/ $3.00

FEED THRU SOLDER RF CAPACTORS

470pf +-20%

5/$1.00 or 100/$15.00 or 1000/$100.00

1000pf/.001uf +-10%

4/$1.00 or 100/$20.00 or 1000/$150.00

E PROMS

2708 1024x1	$2.00 each
2716 2048x8	$4.00 each
27L32/25L32	$10.00 each

FAIRCHILD 4116 16K DYNAMIC RAMS 200ns. Part # 16K75

25 For $25.00 or 100 For $90.00 or 1000 For $750.00

HEWLETT PACKARD MICROWAVE DIODES

1N5711	(5082-2800)	Schottky Barrier Diodes	$1.00 or 10 for $ 8.50
1N5712	(5082-2810)	" " "	$1.50 or 10 for $10.00
1N6263	(HSCH-1001)	" " "	$ .75 or 10 for $ 5.00
5082-2835		" " "	$1.50 or 10 for $10.00
5082-2805	Quad Matched	" " "	per set $5.00 or 10 for $40.00

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MHz electronics

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WATKINS JOHNSON WJ-M6 Double Balanced Mixer

LO and RF 0.2 to 300MHz	IF DC to 300MHz	$21.00
Conversion Loss (SSB)	6.5dB Max. 1 to 50MHz 8.5dB Max. .2 to 300MHz	WITH DATA SHEET
Noise Figure (SSB)	same as above 8.5dB Max. 50 to 300MHz	
Conversion Compression	.3dB Typ.	

NEC (NIPPON ELECTRIC CO. LTD. NE57835/2SC2150 Microwave Transistor

NF Min F=2GHz	dB 2.4 Typ.		MAG F=2GHz	dB 12 Typ.	$5.30
F=3GHz	dB 3.4 Typ.		F=3GHz	dB 9 Typ.	
F=4GHz	dB 4.3 Typ.		F=4GHz	dB 6.5 Typ.	

Ft Gain Bandwidth Product at Vce=8v, Ic=10ma. GHz 4 Min. 6 Typ.
Vcbo 25v Vceo 11v Vebo 3v Ic 50ma. Pt. 250mw

UNELCO RF Power and Linear Amplifier Capacitors

These are the famous capacitors used by all the RF Power and Linear Amplifier manufacturers, and described in the RF Data Book.

5pf	10pf	18pf	30pf	43pf	100pf	200pf	1 to 10pcs. $1.00 ea
5.1pf	12pf	22pf	32pf	51pf	110pf	220pf	11 to 50pcs. $ .90 ea
6.8pf	13pf	25pf	33pf	60pf	120pf	470pf	51 up pcs. $ .80 ea
7pf	14pf	27pf	34pf	80pf	130pf	500pf	
8.2pf	15pf	27.5pf	40pf	82pf	140pf	1000pf	

NIPPON ELECTRIC COMPANY TUNNEL DIODES $7.50

		MODEL 1S2199	1S2200
Peak Pt. Current ma.	Ip	9min. 10Typ. 11max.	9min. 10Typ. 11max.
Valley Pt. Current ma.	Iv	1.2Typ. 1.5max.	1.2Typ. 1.5max.
Peak Pt. Voltage mv.	Vp	95Typ. 120max.	75Typ. 90max.
Projected Peak Pt. Voltage mv.	Vpp Vf=Ip	480min. 550Typ. 630max.	440min. 520Typ. 600max.
Series Res. Ohms	rS	2.5Typ. 4max.	2Typ. 3max.
Terminal Cap. pf.	Ct	1.7Typ. 2max.	5Typ. 8max.
Valley Pt. Voltage mv.	VV	370Typ.	350Typ.

FAIRCHILD / DUMONT Oscilloscope Probes Model 4290B

Input Impedance 10 meg., Input Capacity 6.5 to 12pf., Division Ratio (Volts/Div Factor) 10:1, Cable Length 4Ft. , Frequency Range Over 100MHz.
These Probes will work on all Tektronix, Hewlett Packard, and other Oscilloscopes.

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MOTOROLA RF DATA BOOK

Listsall Motorola RF Transistors / RF Power Amplifiers, Varactor Diodes and much much more.

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1S2200	7.50
2N1561	25.00
2N1562	25.00
2N2857	1.55
2N2857JAN	2.55
2N2876	11.00
2N2947	18.35
2N2948	15.50
2N2949	3.90
2N2950	4.60
2N3375	8.00
2N3553	1.57
2N3632	13.80
2N3818	5.00
2N3866	1.30
2N3924	3.35
2N3927	17.75
2N3950	25.00
2N4072	1.80
2N4127	21.00
2N4427	1.30
2N4428	1.85
2N4957	3.45
2N4958	2.90
2N4959	2.30
2N5090	13.90
2N5108	4.00
2N5109	1.70
2N5160	3.45
2N5177	21.62
2N5179	1.00
2N5583	4.00
2N5589	8.65
2N5590	10.35
2N5591	13.80
2N5635	10.95
2N5637	15.50
2N5641	9.20
2N5642	10.95
2N5643	15.50
2N5645	13.80
2N5646	20.70
2N5691	18.00
2N5764	27.00
2N5836	5.45
2N5842	8.00
2N5849	20.00
2N5913	3.25
2N5922	10.00
2N5923	25.00
2N5941	23.00
2N5942	40.00
2N5944	9.20
2N5945	11.50
2N5946	19.00
2N6080	9.20
2N6081	10.35
2N6082	11.50

PART	PRICE
2N6083	$ 13.25
2N6084	15.00
2N6094 /M9622	11.00
2N6095 /M9623	12.00
2N6096 /M9624	15.50
2N6097	17.25
2N6136	21.85
2N6166	40.25
2N6201	50.00
2N6459	18.00
2N6603	12.00
2N6680	80.00
2SC756A	7.50
2SC781	2.80
2SC1018	1.00
2SC1042	12.00
2SC1070	2.50
2SC1239	2.50
2SC1251	12.00
2SC1306	2.90
2SC1307	5.50
2SC1760	1.50
2SC1970	2.50
2SC2166	5.50
8B1087 (M.A.)	25.00
A50-12	20.00
A283B	5.00
ALD4200N (AVANTEK)	395.00
AM123	97.35
AM688	100.00
BB105B	.52
BD4/4JFBD4 (G.E.)	10.00
BFQ85	1.50
BFR90	1.30
BFR91	1.65
BFW92	1.50
BFX89	1.00
BFY90	1.00
BGY54	25.00
BGY55	25.00
BGY74	25.00
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BL161	10.00
BLX67	11.00
BLY568CF	25.00
BLY87	13.00
BLY88	14.00
BLY89	15.00
BLY90	20.00
BLY351	10.00
C4005	20.00
CA402 (TRW)	25.00
CA405 (TRW)	25.00
CA612B (TRW)	25.00
CA2100 (TRW)	25.00
CA2113 (TRW)	25.00
CA2200 (TRW)	25.00
CA2213 (TRW)	25.00
CA2418 (TRW)	25.00

PART	PRICE
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CA2881-1(TRW)	25.00
CA4101 (TRW)	25.00
CA4201 (TRW)	25.00
CA4600 (TRW)	25.00
CD1889	20.00
CD2545	20.00
CMD514AB	20.00
D4959	10.00
D4987M	20.00
D5147D	10.00
D5506	10.00
D5827AM	20.00
DMD6022	30.00
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HEPS3006	19.90
HEPS3007	25.00
HEPS3010	11.34
HTEF2204 H.P.	112.00
5082-0112 H.P.	14.20
5082-0253 H.P.	105.00
5082-0320 H.P.	58.00
5082-0386 H.P.	POR
5082-0401 H.P.	POR
5082-0438 H.P.	POR
5082-1028 H.P.	POR
5082-2711 H.P.	23.15
5082-3080 H.P.	2.00
5082-3188 H.P.	1.00
5082-6459 H.P.	POR
5082-8323 H.P.	POR
35826E H.P.	POR
35831E H.P.	29.99
35853E H.P.	71.50
35854E H.P.	75.00
HPA0241 H.P.	75.60
HXTR3101 H.P.	7.00
HXTR3102 H.P.	8.75
HXTR6101/2N6617 H.P.	55.00
HXTR6104 H.P.	68.00
HXTR6105 H.P.	31.00
HXTR6106 H.P.	33.00
QSCH1995 H.P.	POR
JO2000 TRW	10.00
JO2001 TRW	25.00
JO4045 TRW	25.00
K3A	10.00
MA450A	10.00
MA41487	POR
MA41765	POR
MA43589	POR
MA43636	POR
MA47044	POR
MA47651	25.50

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GaAs, TUNNEL DIODES, ETC.

PART	PRICE
MA47100	$ 3.05
MA47202	30.80
MA47771	POR
MA47852	POR
MA49558	POR
MB4021	POR
MBD101	1.00
MDO513	POR
MHW1171	42.50
MHW1182	48.60
MHW4171	49.35
MHW4172	51.90
MHW4342	68.75
MLP102	25.00
MM1500	32.32
MM1550	POR
MM1552	50.00
MM1553	50.00
MM1614	10.00
MM2608	5.00
MM3375A	11.50
MM4429	10.00
MM8000	1.15
MM8006	2.30
MO277L	POR
MO283L	POR
MO3757	POR
MP102	POR
MPN3202	10.00
MPN3401	.52
MPN3412	1.00
MPSU31	1.01
MRA2023-1.5 TRW	42.50
MRF212/208	16.10
MRF223	13.25
MRF224	15.50
MRF237	3.15
MRF238	12.65
MRF243	25.00
MRF245	34.50
MRF247	34.50
MRF304	43.45
MRF315	23.00
MRF420	20.00
MRF421	36.80
MRF422	41.40
MRF427	16.10
MRF428	46.00
MRF450/A	13.80
MRF453/A	17.25
MRF454/A	19.90
MRF455/A	16.00
MRF458	19.90
MRF463	25.00
MRF472	1.00
MRF475	2.90
MRF477	11.50
MRF502	1.04

PART	PRICE
MRF503	$ 6.00
MRF504	7.00
MRF509	5.00
MRF511	8.65
MRF605	20.00
MRF629	3.47
MRF644	23.00
MRF816	15.00
MRF823	20.00
MRF901	3.00
MRF8004	2.10
MS261F	POR
MT4150 Fair.	POR
MT5126 Fair.	POR
MT5481 Fair.	POR
MT5482 Fair.	POR
MT5483 Fair.	POR
MT5596 Fair.	POR
MT5764 Fair.	POR
MT8762 Fair.	POR
MV109	.77
MV1401	8.75
MV1624	1.42
MV1805	15.00
MV1808	10.00
MV1817B	10.00
MV1863B	10.00
MV1864A	10.00
MV1864B	10.00
MV1864D	10.00
MV1868D	10.00
MV2101	.90
MV2111	.90
MV2115	1.55
MV2201	.53
MV2203	.53
MV2209	2.00
MV2215	2.00
MWA110	7.45
MWA120	7.80
MWA130	8.25
MWA210	7.80
MWA220	8.25
MWA230	8.65
MWA310	8.25
MWA320	8.65
MWA330	9.50
NEC57835	5.30
ON382	5.00
PPT515-20-3	POR
PRT8637	POR
PSCQ2-160	POR
PT3190	POR
PT3194	POR
PT3195	POR
PT3537	POR
PT4166E	POR
PT4176D	POR

PART	PRICE
PT4186B	$ POR
PT4209	POR
PT4209C	POR
PT4566	POR
PT4570	POR
PT4571	POR
PT4571A	POR
PT4577	POR
PT4590	POR
PT4612	POR
PT4628	POR
PT4640	POR
PT4642	POR
PT5632	POR
PT5749	POR
PT6612	POR
PT6626	POR
PT6709	POR
PT6720	POR
PT8510	POR
PT8524	POR
PT8609	POR
PT8633	POR
PT8639	POR
PT8659	POR
PT8679	POR
PT8708	POR
PT8709	POR
PT8727	POR
PT8731	POR
PT8742	POR
PT8787	POR
PT9790	41.70
PT31962	POR
PT31963	POR
PT31983	POR
PTX6680	POR
RAY-3	24.99
40081	POR
40281	POR
40282	POR
40290	POR
RF110	25.00
SCA3522	POR
SCA3523	POR
SD1065	POR
SS43	POR
TP1014	POR
TP1028	POR
TRW-3	POR
UTO504 Avantek	70.00
UTO511 Avantek	75.00
V15	4.00
V33B	4.00
V100B	4.00
VAB801EC	25.00
VAB804EC	25.00
VAS21AN20	25.00

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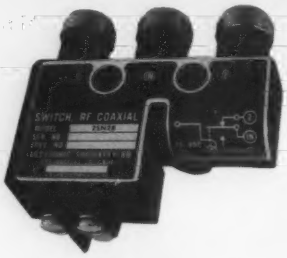
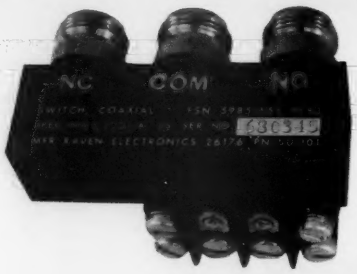
COAXIAL RELAY SWITCHES SPDT

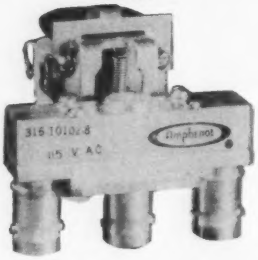
Electronic Specialty Co./Raven Electronics FSN 5985-556-9683 $49.00
Part # 25N28 Part # SU-01
26Vdc Type N Connector, DC to 1 GHz.





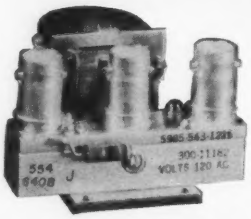
Amphenol
Part # 316-10102-8
115Vac Type BNC DC to 3 GHz.

$29.99



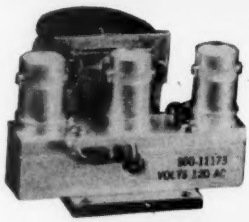
FXR
Part # 300-11182
120Vac Type BNC DC to 4 GHz.
FSN 5985-543-1225

$39.99



FXR
Part # 300-11173
120Vac Type BNC Same
FSN 5985-543-1850

$39.99



BNC To Banana Plug Coax Cable RG-58 36 inch or BNC to N Coax Cable RG-58 36 inch.

$7.99 or 2 For $13.99 or 10 For $50.00 $8.99 or 2 For $15.99 or 10 For $60.00

SOLID STATE RELAYS

P&B Model ECT1DB72 PRICE EACH $5.00	5vdc turn on	120vac contact at 7amps or 20amps on a 10"x 10"x .124 aluminum. Heatsink with silicon grease.
Digisig, Inc. Model ECS-215 PRICE EACH $7.50	5vdc turn on	240vac contact 14amps or 40amps on a 10"x 10"x .124 aluminum. Heatsink with silicon grease.
Grigsby/Barton Model GB7400 PRICE EACH $7.50	5vdc turn on	240vac contact at 15amps or 40amps on a 10"x 10"x .124 aluminum. Heatsink with silicon grease.

NOTE: *** Items may be substituted with other brands or equivalent model numbers. ***

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RECALL PHONE MEMORY TELEPHONE WITH 24 NUMBER AUTO DIALER

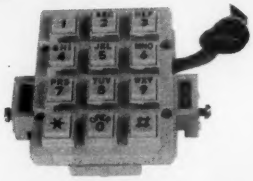
The Recall Phone Telephone employs the latest state of art communications technology.It is a combination telephone and automatic dialer that uses premium-quality,solid-state circuitry to assure high-reliability performance in personal or business applications. $49.99

ARON ALPHA RAPID BONDING GLUE

Super Glue #CE-486 high strength rapid bonding adhesive.Alpha Cyanoacrylate.Set-Time 20 to 40 sec.,0.7fl.oz.(20gm.)
$2.00

TOUCH TONE PAD

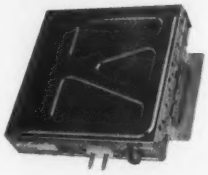
This pad contains all the electronics to produce standard touch-tone tones. New with data.



$9.99 or 10/$89.99

MITSUMI UHF/VHF VARACTOR TUNER MODEL UVE1A

Perfect for those unscrambler projects. New with data.



$19.99 or 10/$149.99

INTEGRATED CIRCUIT.		1 to 10	11up
MC1372P	Color TV Video Modulator Circuit.	$ 4.42	$2.95
MC1358P	IF Amp.,Limiter,FM Detector,Audio Driver,Electronic Attenuator.	5.00	4.00
MC1350P	IF Amplifier	1.50	1.25
MC1330A1P	Low Level Video Detector	1.50	1.15
MC1310P	FM Stereo Demodulator	4.29	3.30
MC1496P	Balanced Modulator/Demodulator	1.50	1.25
LM565N	Phase Locked Loop	2.50	2.00
LM380N14	2Watt Audio Power Amplifier	1.56	1.25
LM1889N	TV Video Modulator	5.00	4.00
NE564N	Phase Locked Loop	10.00	8.00
NE561N	Phase Locked Loop	10.00	8.00

FERRANTI ELECTRONICS AM RADIO RECEIVER MODEL ZN414 INTEGRATED CIRCUIT.
Features:
1.2 to 1.6 volt operating range.,Less than 0.5ma current consumption. 150KHz to 3MHz Frequency range.,Easy to assemble,no alignment necessary. Effective and variable AGC action., Will drive an earphone direct. Excellent audio quality.,Typical power gain of 72dB.,TO-18 package. With data. $2.99 or 10 For $24.99

NI CAD RECHARGEABLE BATTERIES

AA Battery Pack of 6 These are Factory New. $5.00

SUB C Pack of 10 2.5Amp/Hr. $10.00

Gates Rechargeable Battery Packs

12vdc at 2.5Amp/Hr. $11.99
12vdc at 5Amp/Hr. $15.99

We will be closed April 27th through May 2nd...

See you at the Dayton Hamvention!

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"SOCKETS AND CHIMNEYS"

EIMAC TUBE SOCKETS AND CHIMNEYS

		$POR
SK110	Socket	
SK300A	Socket For 4CX5000A,R,J, 4CX10,000D, 4CX15,000A,J	$520.00
SK400	Socket For 4-125A,250A,400A,400C,4PR125A,400A,4-500A,5-500A	260.00
SK406	Chimney For 4-250A,400A,400C,4PR400A	74.00
SK416	Chimney For 3-400Z	36.00
SK500	Socket For 4-1000A/4PR1000A/B	390.00
SK600	Socket For 4CX250B,BC,FG,R,4CX350A,F,FJ	51.00
SK602	Socket For 4CX250B,BC,FG,R,4CX350A,F,FJ	73.00
SK606	Chimney For 4CX250B,BC,FG,R,4CX350A,F,FJ	11.00
SK607	Socket For 4CX600J,JA	60.00
SK610	Socket For 4CX600J,JA	60.00
SK620	Socket For 4CX600J,JA	66.00
SK626	Chimney For 4CX600J,JA	10.00
SK630	Socket For 4CX600J,JA	66.00
SK636B	Chimney For 4CX600J,JA	34.00
SK640	Socket For 4CX600J,JA	36.00
SK646	Chimney For 4CX600J,JA	71.00
SK700	Socket For 4CX300A,Y,4CX125C,F	225.00
SK711A	Socket For 4CX300A,Y,4CX125C,F	225.00
SK740	Socket For 4CX300A,Y,4CX125C,F	86.00
SK770	Socket For 4CX300A,Y,4CX125C,F	86.00
SK800A	Socket For 4CX1000A,4CX1500B	225.00
SK806	Chimney For 4CX1000A,4CX1500B	40.00
SK810	Socket For 4CX1000A,4CX1500B	225.00
SK900	Socket For 4X500A	300.00
SK906	Chimney For 4X500A	57.00
SK1420	Socket For 5CX3000A	650.00
SK1490	Socket For 4CV8000A	585.00

JOHNSON TUBE SOCKETS AND CHIMNEYS

124-111/SK606	Chimney For 4CX250B,BC,FG,R, 4CX350A,F,FJ	$ 10.00
122-0275-001	Socket For 3-500Z, 4-125A, 250A, 400A, 4-500A, 5-500A	(pair)15.00
124-0113-00	Capacitor Ring	15.00
124-116/SK630A	Socket For 4CX250B,BC,FG,R, /4CX350A,F,FJ	55.00
124-115-2/SK620A	Socket For 4CX250B,BC,FG,R, /4CX350A,F,FJ	55.00
	813 Tube Socket	20.00

TUBE CAPS (Plate)

HR1, 4	$11.00
HR2,3, 6 & 7	13.00
HR5, 8	14.00
HR9	17.00
HR10	20.00

CHIP CAPACITORS

.8pf	10pf	100pf*	430pf
1pf	12pf	110pf	470pf
1.1pf	15pf	120pf	510pf
1.4pf	18pf	130pf	560pf
1.5pf	20pf	150pf	620pf
1.8pf	22pf	160pf	680pf
2.2pf	24pf	180pf	820pf
2.7pf	27pf	200pf	1000pf/.001uf*
3.3pf	33pf	220pf*	1800pf/.0018uf
3.6pf	39pf	240pf	2700pf/.0027uf
3.9pf	47pf	270pf	10,000pf/.01uf
4.7pf	51pf	300pf	12,000pf/.012uf
5.6pf	56pf	330pf	15,000pf/.015uf
6.8pf	68pf	360pf	18,000pf/.018uf
8.2pf	82pf	390pf	

PRICES: 1 to 10 - .99¢ 101 to 1000 .60¢ * IS A SPECIAL PRICE: 10 for $7.50
11 to 50 - .90¢ 1001 & UP .35¢ 100 for $65.00
51 to 100 - .80¢ 1000 for $350.00

WATKINS JOHNSON WJ-V907: Voltage Controlled Microwave Oscillator $110.00

Frequency range 3.6 to 4.2GHz, Power ouput, Min. 10dBm typical, 8dBm Guaranteed. Spurious output suppression Harmonic (nf_0), min. 20dB typical, In-Band Non-Harmonic, min. 60dB typical, Residual FM, pk to pk, Max. 5KHz, pushing factor, Max. 8KHz/V, Pulling figure (1.5:1 VSWR), Max. 60MHz, Tuning voltage range +1 to +15volts, Tuning current, Max. -0.1mA, modulation sensitivity range, Max. 120 to 30MHz/V, Input capacitance, Max. 100pf, Oscillator Bias +15 +-0.05 volts @ 55mA, Max.

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TUBES

TYPE	PRICE	TYPE	PRICE	TYPE	PRICE
2E26	$ 5.69	KT88	$ 20.00	6562/6974A	$ 50.00
2K28	100.00	DX362	50.00	6832	22.00
2X1000A	300.00	DX415	50.00	6883/8032A/8552	7.00
3B22	19.75	572B/T160L	49.00	6897	110.00
3B28/866A	7.50	592/3-200A3	144.00	6907A	75.00
3-500Z	102.00	807	7.50	6939	15.00
3-1000Z	400.00	811	10.00	7094	125.00
3CX1000A/8283	428.00	811A	15.00	7117	17.00
3CX1500A7/887	533.00	812A	35.00	7211	60.00
3X2500A3	200.00	813	50.00	7289/3CX100A5	34.00
3CX3000A7	490.00	829B	38.00	7360	11.00
4-65A/8165	45.00	832A	28.00	7377	67.00
4-125A/4D21	58.00	4624	310.00	7408	4.00
4-250A/5D22	75.00	4662	80.00	7650	250.00
4-400A/8432	90.00	4665	585.00	7695	8.00
4-400C/6775	95.00	5675/A	25.00	7843	58.00
4-1000A/8166	300.00	5721	200.00	7854	83.00
4B32	22.00	5768	85.00	7868	5.00
4E27A/5-125B	155.00	5836	100.00	7894	12.00
4CS250R	146.00	5837	100.00	8072	65.00
4X150A/7034	30.00	5861/EC55	110.00	8117A	130.00
4X150D/7035	40.00	5876A	25.00	8121	60.00
4X150G/8172	100.00	5881/6L6W	6.00	8122	100.00
4X250B	30.00	5893	45.00	8236	30.00
4CX250B/7203	45.00	5894/A	50.00	8295/PL172	506.00
4CX250F/G/8621	55.00	5894/B	60.00	8462	100.00
4CX250K/8245	100.00	5946	258.00	8505A	73.50
4CX250R/7580W	69.00	6080	10.00	8533W	92.00
4CX300A/8167	140.00	6083/AX9909	89.00	8560/A	65.00
4CX350A/8321	83.00	6098/6AK6	14.00	8560AS	90.00
4CX350F/J/8904	95.00	6115/A	110.00	8608	34.00
4X500A	282.00	6146	7.00	8637	38.00
4CX600J/8809	607.00	6146A	7.50	8643	100.00
4CW800F	625.00	6146B/8298A	8.50	8647	123.00
4CX1000A/8168	340.00	6146W	14.00	8737/5894B	60.00
4CX1500B/8660	397.00	6156	66.00	8873	260.00
4CX5000A/8170	932.00	6159	15.00	8874	260.00
4CX10000D/8171	990.00	6161	233.00	8875	260.00
4CX15000A/8281	1260.00	6291	125.00	8877	533.00
4PR60A	100.00	6293	12.00	8908	12.00
4PR60B/8252	175.00	6360	5.00	8930/651Z	71.00
4PR400A/8188	192.00	6524	53.00	8950	12.00
5CX1500A	569.00	6550	10.00		
6BK4C	6.00	6JM6	6.00	6LQ6 (Sylvania)	7.50
6DQ5	5.00	6JN6	6.00	6LU8	6.00
6FW5	6.00	6JS6B	6.00	6LX6	6.00
6GE5	6.00	6KG6/EL505	6.00	6ME6	6.00
6GJ5	6.00	6KM6	6.00	12BY7A	4.00
6HS5	6.00	6KN6	6.00	12JB6A	6.00
6JB5/6HE5	6.00	6LF6	6.00	6KD6	6.00
6JB6A	6.00	6LQ6 (GE)	6.00	6JT6A	6.00
				6KD6	6.00

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"FILTERS"

COLLINS Mechanical Filter #526-9724-010 MODEL F455Z32F

455KHZ at 3.2KHz wide. May be other models but equivalent. May be used or new. $15.99

ATLAS Crystal Filters

5.595-2.7/8/LSB, 5.595-2.7/LSB
8 pole 2.7KHz wide Upper sideband. Impedence 800ohms 15pf In/800ohms 0pf out. 19.99

5.595-2.7/8/U, 5.595-2.7/USB
8 pole 2.7Khz wide Upper sideband. Impedence 800ohms 15pf In/800ohms 0pf out. 19.99

5.595-.500/4, 5.595-.500/4/CW
4 pole 500 cycles wide CW. Impedance 800ohms 15pf In/800ohms 0pf out. 19.99

9.0USB/CW
6 pole 2.7KHz wide at 6dB. Impedance 680ohms 7pf In/300ohms 8pf out. CW-1599Hz 19.99

KOKUSAI ELECTRIC CO, Mechanical Filter #MF-455-ZL/ZU-21H

455KHz at Center Frequency of 453.5KC. Carrier Frequency of 455KHz 2.36KC Bandwidth.
Upper sideband. (ZU) 19.99
Lower sideband. (ZL) 19.99

CRYSTAL FILTERS

NIKKO	FX-07800C	7.8MHz	$10.00
TEW	FEC-103-2	10.6935MHz	10.00
SDK	SCH-113A	11.2735MHz	10.00
TAMA	TF-31H250	CF 3179.3KHz	19.99
TYCO/CD	001019880	10.7MHz 2pole 15KHz bandwidth	5.00
MOTOROLA	4884863B01	11.7MHz 2pole 15KHz bandwidth	5.00
PTI	5350C	12MHz 2pole 15KHz bandwidth	5.00
PTI	5426C	21.4MHz 2pole 15KHz bandwidth	5.00
PTI	1479	10.7MHz 8pole bandwidth 7.5KHz at 3dB, 5KHz at 6dB	20.00
COMTECH	A10300	45MHz 2pole 15KHz bandwidth	6.00
FRC	ERXF-15700	20.6MHz 36KHz wide	10.00
FILTECH	2131	CF 7.825MHz	10.00

CERAMIC FILTERS

AXEL	4F449	12.6KC Bandpass Filter 3dB bandwidth 1.6KHz from 11.8-13.4KHz	10.00
CLEVITE	TO-01A	455KHz+-2KHz bandwidth 4-7% at 3dB	5.00
	TCF4-12D36A	455KHz+-1KHz bandwidth 6dB min 12KHz, 60dB max 36KHz	10.00
MURATA	BFB455B	455KHz	2.50
	BFB455L	455KHz	3.50
	CFM455E	455KHz +-5.5KHz at 3dB , +-8KHz at 6dB , +-16KHz at 50dB	6.65
	CFM455D	455KHz +-7KHz at 3dB , +-10KHz at 6dB , +-20KHz at 50dB	6.65
	CFR455E	455KHz +-5.5KHz at 3dB , +-8KHz at 6dB , +-16KHz at 60dB	8.00
	CFU455B	455KHz +-2KHz bandwidth +-15KHz at 6dB, +-30KHz at 40dB	2.90
	CFU455C	455KHz +-2KHz bandwidth +-12.5KHz at 6dB , +-24KHz at 40dB	2.90
	CFU455G	455KHz +-1KHz bandwidth +-4.5KHz at 6dB , +-10KHz at 40dB	2.90
	CFU455H	455KHz +-1KHz bandwidth +-3KHz at 6dB , +-9KHz at 40dB	2.90
	CFU455I	455KHz +-1KHz bandwidth +-2KHz at 6dB , +-6KHz at 40dB	2.90
	CFW455D	455KHz +-10KHz at 6dB , +-20KHz at 40dB	2.90
	CFW455H	455KHz +-3KHz at 6dB , +-9KHz at 40dB	2.90
	SFB455D	455KHz	2.50
	SFD455D	455KHz +-2KHz , 3dB bandwidth 4.5KHz +-1KHz	5.00
	SFE10.7MA	10.7MHz 280KHz +-50KHz at 3dB , 650KHz at 20dB	2.50
	SFE10.7MS	10,7MHz 230KHz +-50KHz at 3dB , 570KHz at 20dB	2.50
	SFG10.7MA	10.7MHz	10.00
NIPPON	LF-B4/CFU455I	455KHz +-1KHz	2.90
	LF-B6/CFU455H	455KHz +-1KHz	2.90
	LF-B8	455KHz	2.90
	LF-C18	455KHz	10.00
TOKIN	CF455A/BFU455K	455KHz +-2KHz	5.00
MATSUSHIRA	EFC-L455K	455KHz	7.00

SPECTRA PHYSICS INC. Model 088 HeNe LASER TUBES

POWER OUTPUT 1.6MW. BEAM DIA. .75MM BEAM DIR. 2.7MR 8KV STARTING VOLTAGE DC
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606A	50KHz to 65MHz in 6 bands +-1%,Output level adjustable 0.1uV to 3V into 50 ohms.Built-in crystal calibrator.400 -1000Hz modulation.	$ 650.00
606B	Same as above but has frequency control feature to allow operation with HP 8708A Synchronizer.	$1100.00
608C	10MHz to 480MHz,0-1uV-1V into 50 ohms,AM,CW,or pulse modulation, calibrated attenuator.	$ 500.00
608D/ TS510	10MHz to 420MHz, 0.1uV-0.5V into 50 ohms,+-0.5% accuracy, built-in crystal calibrator, AM-CW or pulse output.	$ 375.00
608E	Improved version of popular 608C.Up to 1V output.Improved stability,low residual FM.	$1450.00
608F	10MHz to 455MHz in 5 bands +-1% frequency accuracy with built-in crystal calibrator.Can be used with HP 8708A Synchronizer. Output continuously adjustable from .1uV to .5V into 50 ohms.	$1100.00
612A	450-1230MHz ,0.1uV-0.5V into 50 ohms,calibrated output.	$ 750.00
614A	900-2100MHz with many features including calibrated output and all modulation characteristics.	$ 500.00
616A/ TS403	Direct reading and direct control from 1.8 to 4.2GHz. The H.P.616A features +-1.5dB calibrated output accuracy from -3127dBm to -dBm.The output is directly calibrated in microvolts and dBm with continuous monitoring. Simple operation frequency dial accuracy is +-1% and stability exceeds 0.005%-/ C change in ambient temperature. Calibrated attenuator is within +-1.5dB over entire output band. 50 ohm impedance unit has internal pulse modulation with rep rate variable from 40 Hz to 4KHz,variable pulsewidth(1 to 10usec)and variable pulse delay(3 to 300usec).External modulating inputs increas versatility.	$ 375.00
616B	Same as above but later model.	$ 600.00
618B	3.8 to 7.6GHz range,with calibrated output and selection of pulse-FM or square wave modulation.	$ 600.00
618C	Same as above but later model.	$2200.00
620A	7 to 11GHz range,with calibrated output and selection of pulse-FM or square wave modulation.	$ 750.00
620B	Same as above but later model.	$2200.00
626A	10 to 15GHz,10mw output power with calibrated output and pulse-square wave or FM modulation.	$4200.00
8708A	Synchronizer used with 606B,608F.The synchronizer is a phase-lock frequency stabilizer which provides crystal-oscillator frequency stability to 430MHz in the 608F signal generator.Phase locking eliminates microphonics and drift resulting in excellent frequency stability.The 8708A includes a vernier which can tune the reference oscillator over a range of +-0.25% permitting frequency settability to 2 parts in 10 to the seventh.Provides a very stable signal that satisfies many critical applications.	
	(With HP 606B or 608F)	$ 350.00
	(Without)	$ 450.00
EMC-10	ELECTROMETRICS EMC-10 RFI/EMI RECEIVER Low frequency analyzer covering 20Hz to 50KHz frequency range.Extendable to 500 KHz in wideband mode.	$2500.00
NF-105F	Empire Devices Field Intensity Meter. Has NF-105/TA,NF-105/TX,NF-105/T1,NF-105/T2,NF-105/T3. Covers 14KHz to 1000MHz.	$2100.00

ALL EQUIPMENT CARRY A 30 DAY GUARANTEE.

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DEFECTIVE MATERIAL: All claims for defective material must be made within sixty (60) days after receipt of parcel. All claims must include the defective material (for testing purposes), our invoice number, and the date of purchase. All returns must be packed properly or it will void all warranties.

DELIVERY: Orders are normally shipped within 48 hours after receipt of customer's order. If a part has to be backordered the customer is notified. Our normal shipping method is via First Class Mail or UPS depending on size and weight of the package. On test equipment it is by Air only, FOB shipping point.

FOREIGN ORDERS: All foreign orders must be prepaid with cashier's check or money order made out in U.S. Funds. We are sorry but C.O.D. is not available to foreign countries and Letters of Credit are not an acceptable form of payment either. Further information is available on request.

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NEW LOW-NOISE PREAMPS

New low-noise microwave transistors make preamps in the 0.9 to 1.0 dB noise figure range possible without the fragility and power supply problems of gas-fet's. Units furnished wired and tuned to ham band. Can be easily retuned to nearby freq.

Models LNA( ), P30, and P432 shown

Model	Tunable Freq Range	Noise Figure	Gain	Price
LNA 28	20-40	0.9 dB	20 dB	$39.95
LNA 50	40-70	0.9 dB	20 dB	$39.95
LNA 144	120-180	1.0 dB	18 dB	$39.95
LNA 220	180-250	1.0 dB	17 dB	$39.95
LNA 432	380-470	1.0 dB	18 dB	$44.95

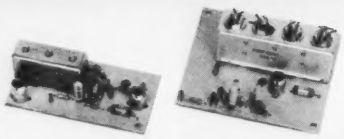
ECONOMY PREAMPS

Our traditional preamps, proven in years of service. Over 20,000 in use throughout the world. Tuneable over narrow range. Specify exact freq. band needed. Gain 16-20 dB. NF = 2 dB or less. VHF units available 27 to 300 MHz. UHF units available 300 to 650 MHz.

- P30K, VHF Kit less case $14.95
- P30C, VHF Kit with case $20.95
- P30W, VHF Wired/Tested $29.95
- P432K, UHF Kit less case $18.95
- P432C, UHF Kit with case $24.95
- P432W, UHF Wired/Tested $33.95

P432 also available in broadband version to cover 20-650 MHz without tuning. Same price as P432; add "B" to model #.

HELICAL RESONATOR PREAMPS



Our lab has developed a new line of low-noise receiver preamps with helical resonator filters built in. The combination of a low noise amplifier similar to the LNA series and the sharp selectivity of a 3 or 4 section helical resonator provides increased sensitivity while reducing intermod and cross-band interference in critical applications. See selectivity curves at right. Noise figure = 1 to 1.2 dB. Gain = 12 to 15 dB.

Model	Tuning Range	Price
HRA-144	143-150 MHz	$49.95
HRA-220	213-233 MHz	$49.95
HRA-432	420-450 MHz	$59.95

RECEIVING CONVERTERS

Models to cover every practical rf & if range to listen to SSB, FM, ATV, etc. NF = 2 dB or less.

	Antenna Input Range	Receiver Output
VHF MODELS	28-32	144-148
	50-52	28-30
Kit $44.95	50-54	144-148
Less Case $39.95	144-146	28-30
Wired $59.95	145-147	28-30
	144-144.4	27-27.4
	146-148	28-30
	144-148	50-54
	220-222	28-30
	220-224	144-148
	222-226	144-148
	220-224	50-54
	222-224	28-30
UHF MODELS	432-434	28-30
	435-437	28-30
Kit $54.95	432-436	144-148
Less Case $49.95	432-436	50-54
Wired $74.95	439.25	61.25

SCANNER CONVERTERS Copy 72-76, 135-144, 240-270, 400-420, or 806-894 MHz bands on any scanner. Wired/tested Only $79.95.

SPECIAL FREQUENCY CONVERTERS made to custom order $119.95. Call for details.

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For SSB, CW, ATV, FM, etc. Why pay big bucks for a multi mode rig for each band? Can be linked with receive converters for transceive. 2 watts output.

	Exciter Input Range	Antenna Output
For VHF,	28-30	144-146
Model XV2	28-29	145-146
Kit $79.95	28-30	50-52
Wired $119.95	27-27.4	144-144.4
(Specify band)	28-30	220-222
	50-54	220-224
	144-146	50-52
	50-54	144-148
	144-146	28-30
For UHF,	28-30	432-434
Model XV4	28-30	435-437
Kit $99.95	50-54	432-436
Wired $149.95	61.25	439.25
	144-148	432-436*

*Add $35 for 2M input

FREE OFFER

For limited time, buy a transmit converter above with 40-45W PA ($129.95) and get $39.95 cabinet FREE.

SAVE A BUNDLE ON VHF FM TRANSCEIVERS!

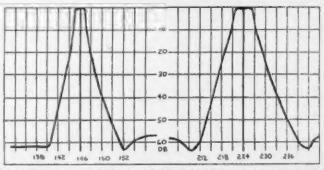
FM-5 PC Board Kit – **ONLY $159.95** complete with controls, heatsink, etc. 10 Watts, 5 Channels, for 6M, 2M, or 220

Cabinet Kit, complete with speaker, knobs, connectors, hardware. Only $59.95

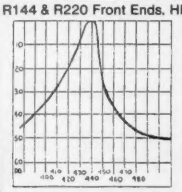
REPEAT OF A SELLOUT!

While supply lasts, get $59.95 cabinet kit free when you buy an FM-5 Transceiver kit. Where else can you get a complete transceiver for only $159.95?

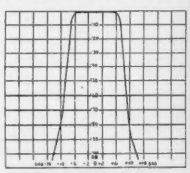
LOOK AT THESE ATTRACTIVE CURVES!



R144 & R220 Front Ends, HRA 144/220, & HRF-144/220

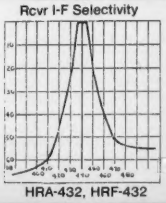


R451 Receiver Front End



Rcvr I-F Selectivity

Typical Selectivity Curves of Receivers and Helical Resonators.



HRA-432, HRF-432

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JUST LOOK AT THESE PRICES!

Band	Kit	Wired/Tested
6M,2M,220	$595	$745
440	$645	$795

Both kit and wired units are complete with all parts, modules, hardware, and crystals.

CALL OR WRITE FOR COMPLETE DETAILS.

Also available for remote site linking/crossband & 10M.

FEATURES:

- SENSITIVITY SECOND TO NONE; TYPICALLY 0.15 uV ON VHF, 0.2 uV ON UHF.
- SELECTIVITY THAT CAN'T BE BEAT! BOTH 8 POLE CRYSTAL FILTER & CERAMIC FILTER FOR GREATER THAN 100 dB AT ± 12KHZ. HELICAL RESONATOR FRONT ENDS. SEE R144, R220, AND R451 SPECS IN RECEIVER AD BELOW.
- OTHER GREAT RECEIVER FEATURES: FLUTTER-PROOF SQUELCH, AFC TO COMPENSATE FOR OFF-FREQ TRANSMITTERS, SEPARATE LOCAL SPEAKER AMPLIFIER & CONTROL.
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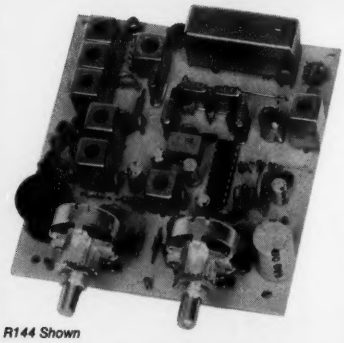
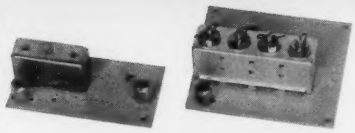


R144 Shown

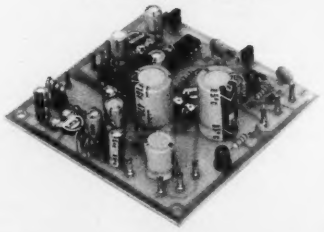
- **R144/R220 FM RCVRS** for 2M or 220 MHz. 0.15uV sens.; 8 pole xtal filter & ceramic filter in i-f, helical resonator front end for exceptional selectivity (curves at left). AFC incl., xtal oven avail. Kit only $119.95
- **R451 FM RCVR** Same but for uhf. Tuned line front end, 0.2 uV sens. Kit only $119.95.
- **R73 FM RCVR** for 10M, 6M, 2M, 220, or commercial bands. As above, but w/o AFC or hel. res. Kits only $109.95. Also avail w/4 pole filter, only $94.95/ kit.
- **R110 VHF AM RECEIVER** kit for VHF aircraft band or ham bands. Only $84.95.
- **R110 UHF AM RECEIVER** for UHF uses, including special 296 MHz model to hear SPACE SHUTTLE. Kit $94.95.



- **HELICAL RESONATOR FILTERS** available separately on pcb w/connectors.

  HRF-144 for 143-150 MHz $34.95
  HRF-220 for 213-233 MHz $34.95
  HRF-432 for 420-450 MHz $44.95

  (See selectivity curves at left.)



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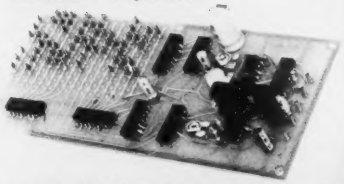

- **A16 RF TIGHT BOX** Deep drawn alum. case with tight cover and no seams. 7 x 8 x 2 inches. Only $18.00.

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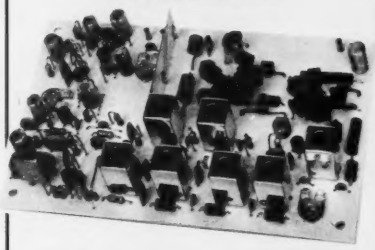
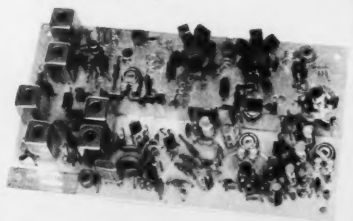


- **T51 VHF FM EXCITER** for 10M, 6M, 2M, 220 MHz or adjacent bands. 2 Watts continuous. Kits only $59.95



- **T451 UHF FM EXCITER** 2 to 3 Watts on 450 ham band or adjacent. Kits only $69.95.
- **VHF & UHF LINEAR AMPLIFIERS.** Use on either FM or SSB. Power levels from 10 to 45 Watts to go with exciters & xmtg converters. Kits from $69.95.

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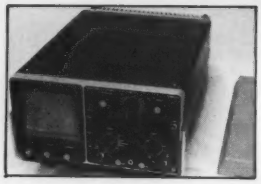

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14-pin	.10	24-pin	.17
16-pin	.11	28-pin	.19
18-pin	.13	40-pin	.27
20-pin	.14		

IC sockets w/wrap

14-pin	.30	40-pin	.90
16-pin	.35		

Dip switches
4 position .60 10 position $1.60
7 position .80

12VDC lamps, 60ma
1/8" round × ½" long
w/12" leads .29 ea.
or 10 for $2.00

Electrolytic Caps.
Mallory #TCG1220U075N3C3P
1200uf 75VDC $1.39 ea.
or 4 for $4.00

Mallory #TCG3720040N3L3P
3700uf 40VDC $1.00 ea.
or 10 for $8.00

Nichion #50ULB150-T
150uf 50VDC .39 ea.
or 4 for $1.00

Mallory #TCG102U040J2C3P
1000uf 40VDC .89 ea.
or 3 for $2.00

Ayer Eng. #85CX442U006GLY
4400uf 6VDC .69 ea.
or 2 for $1.00

MEM 631 Dual Gate Diode
protected FET vds = 25V
Id = 30ma mhos = 800(min).50ea.

Temp. controlled Heating
Plate 4" × 9" element size
hot plate size 5⅛" × 10"
120vac @ 120 watts $1.99

Whistle Activated Switch
$2.50 ea. or 3 for $6.00

SCR 25 amps 600 Volts
stud mount $1.50

Gould Nickel Cadmium Batteries
pack of 2 part #405408
2.4V @ 600mah (new) $3.29

G.E. Rechargeable Nickel
Battery pack 6 cells
a total of 14.4vdc @ 1ah
#41B001LD5G1 (used) $7.99

1N4148/1N914 Switching Diodes
30 for $1.00 or 120 for $3.00

NE/CA555V Timer IC's
.39 ea. or 10 for $3.00

Dual Color Led's
.40 ea. or 10 for $3.29

Trimpots Thumbwheel type
.30 ea. or 10 for $2.50
sold not mixed

100 ohm	20K ohm
150 ohm	25K ohm
200 ohm	200K ohm
250 ohm	250K ohm
500 ohm	500K ohm
1K ohm	750K ohm
1.5K ohm	2meg ohm
2K ohm	2.2meg ohm
2.5K ohm	3meg ohm
5K ohm	5meg ohm
10K ohm	

5 pin din jack & plug set
1 male & 1 female $1.00/set
or 10 sets for $6.50

TO-3 Transistor sockets
phenolic type .29 ea.
or 6 for $1.00

Cable ties #T-18R 100 per bag
mil. spec. #MS-33685-4
4" long made by Tytor Corp.
$2.00/bag of 100 or 10 bags/
1000 for $15.00

4MHZ Crystals HC18/U $1.00
8MHZ Crystals HC18/U $1.00
100KHZ Crystals HC33/U $3.99

TRANSFORMERS

Schott Corp. #67069940 input 117vac
output 26.8vct @ 800ma
26.8vct @ 800ma
21.9vct @ 1.1amp $9.99

Triad F23U input 115vac
output 10vct @ 7amps $12.99

NATA #30468359 input 117vac
output 25.2vct @ 2.8amps $6.99

Electro Vectro #E30554 input 117vac
output 17v @ 1.5amps
output 17v @ 1.5amps $6.99

Keystone #PL-25-10 input 117vac
output 25vct @ 20va
output 10vct @ 4va $5.99

Stancor #P8657 input 117vac
output 12v @ 2amps $5.99

Stancor #P-8720 input 230vac
output 24vct @ 85ma $2.99

Plug in the wall #Pitb-86 input 120vac
output 6vac @ 10ma $2.99

Plug in the wall #2-2286 input 120vac
output 5.8vdc @ 125ma $2.99

Plug in the wall #C-160 input 117vac
output 3.6vdc @ 60ma $2.99

Southern #EX-1163-T input 110vac or
220vac output 17vct @ 1amp $3.99

Triad F23U 115vac input
10vct @ 7amps output $8.99

Triad F74U Transformer input 117vac
output 28vct @ 2amps &
output 28vct @ 2amps $19.99

IR 3E05 3amp 50piv Rectifier
10 for $1.00 or 100 for $6.00

9Volt Battery Clips 10 for .99

40673 FET N-channel MOS FET
.79 ea. or 10 for $5.00

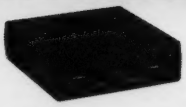
MC6860L 0-600 bps Digital
Modem $4.99

95H90DC Hi-speed Divide
10/11 Prescaler $6.00

Touch Tone Pad
This pad contains all electronics to produce standard touch-tone tones. It has an AMI S2559 digital tone. Generator has power Cmos IC. Uses TV crystal, standard (3.58MHZ) to derive all frequencies thus providing very high mute drivers on chip. Interfaces directly to a standard telephone push-button or calculator type X-4 keyboard. The total harmonic distortion is below industry specification on chip generation of a reference voltage to assure amplitude stability of the dual tones over the operating voltage & temperature range. Dual tone as well as single tone capability. $6.99

Gates Rechargeable Lead Acid Batteries
pack of 6 2Volt 2.5AH D-Cells
(used) $7.99

ramsey the first name in Counters !



9 DIGITS 600 MHz $129.95 WIRED

PRICES

CT-90 wired, 1 year warranty	$129.95
CT-90 Kit, 90 day parts warranty	109.95
AC-1 AC adaptor	3.95
BP-1 Nicad pack +AC Adapter/Charger	12.95
OV-1, Micro-power Oven time base	49.95
External time base input	14.95

The CT-90 is the most versatile, feature packed counter available for less than $300.00! Advanced design features include; three selectable gate times, nine digits, gate indicator and a unique display hold function which holds the displayed count after the input signal is removed! Also, a 10mHz TCXO time base is used which enables easy zero beat calibration checks against WWV. Optionally; an internal nicad battery pack, external time base input and Micro-power high stability crystal oven time base are available. The CT-90, performance you can count on!

SPECIFICATIONS:

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 10 MV to 150 MHz Less than 50 MV to 500 MHz
Resolution:	0.1 Hz (10 MHz range) 1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	9 digits 0.4" LED
Time base:	Standard-10.000 mHz, 1.0 ppm 20-40°C. Optional Micro-power oven-0.1 ppm 20-40°C
Power:	8-15 VAC @ 250 ma

7 DIGITS 525 MHz $99.95 WIRED

SPECIFICATIONS:

Range:	20 Hz to 525 MHz
Sensitivity:	Less than 50 MV to 150 MHz Less than 150 MV to 500 MHz
Resolution:	1.0 Hz (5 MHz range) 10.0 Hz (50 MHz range) 100.0 Hz (500 MHz range)
Display:	7 digits 0.4" LED
Time base:	1.0 ppm TCXO 20-40°C
Power:	12 VAC @ 250 ma

The CT-70 breaks the price barrier on lab quality frequency counters. Deluxe features such as; three frequency ranges - each with pre-amplification, dual selectable gate times, and gate activity indication make measurements a snap. The wide frequency range enables you to accurately measure signals from audio thru UHF with 1.0 ppm accuracy - that's .0001%! The CT-70 is the answer to all your measurement needs, in the field, lab or ham shack.

PRICES:

CT-70 wired, 1 year warranty	$99.95
CT-70 Kit, 90 day parts warranty	84.95
AC-1 AC adapter	3.95
BP-1 Nicad pack + AC adapter/charger	12.95

7 DIGITS 500 MHz $79.95 WIRED

PRICES:

MINI-100 wired, 1 year warranty	$79.95
AC-Z Ac adapter for MINI-100	3.95
BP-Z Nicad pack and AC adapter/charger	12.95

Here's a handy, general purpose counter that provides most counter functions at an unbelievable price. The MINI-100 doesn't have the full frequency range or input impedance qualities found in higher price units, but for basic RF signal measurements, it can't be beat! Accurate measurements can be made from 1 MHz all the way up to 500 MHz with excellent sensitivity throughout the range, and the two gate times let you select the resolution desired. Add the nicad pack option and the MINI-100 makes an ideal addition to your tool box for "in-the-field" frequency checks and repairs.

SPECIFICATIONS:

Range:	1 MHz to 500 MHz
Sensitivity:	Less than 25 MV
Resolution:	100 Hz (slow gate) 1.0 KHz (fast gate)
Display:	7 digits, 0.4" LED
Time base:	2.0 ppm 20-40°C
Power:	5 VDC @ 200 ma

8 DIGITS 600 MHz $159.95 WIRED

NEW READ RECEIVER FREQUENCY

SPECIFICATIONS:

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 25 mv to 150 MHz Less than 150 mv to 600 MHz
Resolution:	1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	8 digits 0.4" LED
Time base:	2.0 ppm 20-40°C
Power:	110 VAC or 12 VDC

The CT-50 is a versatile lab bench counter that will measure up to 600 MHz with 8 digit precision. And, one of its best features is the Receive Frequency Adapter, which turns the CT-50 into a digital readout for any receiver. The adapter is easily programmed for any receiver and a simple connection to the receiver's VFO is all that is required for use. Adding the receiver adapter in no way limits the operation of the CT-50, the adapter can be conveniently switched on or off. The CT-50, a counter that can work double-duty!

PRICES:

CT-50 wired, 1 year warranty	$159.95
CT-50 Kit, 90 day parts warranty	119.95
RA-1, receiver adapter kit	14.95
RA-1 wired and pre-programmed (send copy of receiver schematic)	29.95

DIGITAL MULTIMETER $99.95 WIRED

PRICES:

DM-700 wired, 1 year warranty	$99.95
DM-700 Kit, 90 day parts warranty	79.95
AC-1, AC adaptor	3.95
BP-3, Nicad pack +AC adapter/charger	19.95
MP-1, Probe kit	2.95

The DM-700 offers professional quality performance at a hobbyist price. Features include; 26 different ranges and 5 functions, all arranged in a convenient, easy to use format. Measurements are displayed on a large 3½ digit, ½ inch LED readout with automatic decimal placement, automatic polarity, overrange indication and overload protection up to 1250 volts on all ranges, making it virtually goof-proof! The DM-700 looks great, a handsome, jet black, rugged ABS case with convenient retractable tilt bail makes it an ideal addition to any shop.

SPECIFICATIONS:

DC/AC volts:	100uV to 1 KV, 5 ranges
DC/AC current:	0.1 uA to 2.0 Amps, 5 ranges
Resistance:	0.1 ohms to 20 Megohms, 6 ranges
Input impedance:	10 Megohms, DC/AC volts
Accuracy:	0.1% basic DC volts
Power:	4 'C' cells

AUDIO SCALER

For high resolution audio measurements, multiplies UP in frequency.

- Great for PL tones
- Multiplies by 10 or 100
- 0.01 Hz resolution!

$29.95 Kit $39.95 Wired

ACCESSORIES

Telescopic whip antenna - BNC plug	$ 7.95
High impedance probe, light loading	15.95
Low pass probe, for audio measurements	15.95
Direct probe, general purpose usage	12.95
Tilt bail, for CT 70, 90, MINI-100	3.95
Color burst calibration unit, calibrates counter against color TV signal	14.95

COUNTER PREAMP

For measuring extremely weak signals from 10 to 1,000 MHz. Small size, powered by plug transformer-included.

- Flat 25 db gain
- BNC Connectors
- Great for sniffing RF with pick-up loop

$34.95 Kit $44.95 Wired

ramsey electronic's, inc. VISA master charge
2575 Baird Rd. Penfield, NY 14526 ↙ 62

PHONE ORDERS
CALL 716-586-3950

TERMS: Satisfaction guaranteed. Examine for 10 days, if not pleased return in original form for refund. Add 5% for shipping insurance to a maximum of $10. Overseas add 15% COD add $2. Orders under $10 add $1.50. NY residents add 7% tax.

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Jun's Electronics, 3919 Sepulveda Blvd., Culver City CA 90230, 390-8003. Trades 463-1888 San Diego. 827-5732 (Reno NV).

Fontana CA

Complete lines ICOM, DenTron, Ten-Tec, Mirage, Cubic, Lunar, over 4000 electronic products for hobbyist, technician, experimenter. Also CB radio, landmobile. **Fontana Electronics, 8628 Sierra Ave., Fontana CA 92335, 822-7710.**

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Bay area's newest Amateur Radio store. New & used Amateur Radio sales & service. We feature Kenwood, ICOM, Azden, Yaesu, Ten-Tec, Santec & many more. **Shaver Radio, Inc., 1378 So. Bascom Ave., San Jose CA 95128, 998-1103.**

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Ross WB7BYZ has the Largest Stock of Amateur Gear in the Intermountain West and the Best Prices. Call me for all your ham needs. **Ross Distributing, 78 So. State, Preston ID 83263, 852-0830.**

Bloomington IL

ROHN TOWERS—Large stock plus all UNARCO ROHN items available for fast drop shipments. Wholesale prices to all users. Also wholesale distributor for **Antenna Specialists, Regency, and Hy-Gain. Hill Radio 2503 G.E. Road Box 1405, Bloomington IL 61701 663-2141**

Terre Haute IN

Your ham headquarters located in the heart of the midwest. **Hoosier Electronics, Inc., -9 Meadows Center, P.O. Box 3300, Terre Haute IN 47803, 238-1456.**

Littleton MA

The Reliable Ham Store Serving N.E. Full line of ICOM & Kenwood. Yaesu HTs, Drake, Daiwa, B&W accessories, Curtis & Trac keyers. Larsen, Hustler, Telex/Hy-Gain products. Mirage amps., Astron P.S., Alpha Delta protectors, ARRL & Kantronics instruction aids. Whistler radar detectors. Full line of coax fittings. **TEL-COM Electronic Communications 675 Great Rd. (Rt. 119), Littleton MA 01460, 486-3400/3040.**

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See us for products like Ten-Tec, R. L. Drake, DenTron and many more. Open Monday through Saturday, 0830 to 1730. WB8VGR, WB8UXO, WD8OKN and W8RP behind the counter. **Purchase Radio Supply, 327 E. Hoover Ave., Ann Arbor MI 48104, 668-8606.**

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Avantek transistors, amplifiers, oscillators and LNA's Coaxial cable and connectors. Blonder Tongue dealer with Microwave laboratory. **Applied Specialties, Inc., 10101G Bacon Drive, Beltsville, Maryland 20705. Wash. 595-5393, Balt. 792-2211. 7:30 a.m. to 6:00 p.m. Monday thru Friday.**

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Your company name and message can contain up to 25 words for as little as $150 yearly (prepaid), or $15 per month (prepaid quarterly). No mention of mail-order business or area code permitted. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the July '83 issue must be in our hands by May 1st. Mail to 73 Magazine, Peterborough NH 03458. ATTN: Nancy Ciampa.

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PROPAGATION

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Whiting NJ 08759

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7	7	7	7	7	7A	14	14	14
ARGENTINA	21	14A	14	14	14	7	14	21	21A	21A	21A	21A
AUSTRALIA	21	21	14	14	7B	7B	7B	7B	7B	7A	21	21
CANAL ZONE	21	14	14	7	7	7	14	14A	21	21	21A	21A
ENGLAND	14	7	7	7	7	7A	14	14	21	21	14A	14
HAWAII	21	14	14	14B	7B	7B	7	14	14	14	14	14A
INDIA	14	14	14B	7B	7B	7B	14	14	14	14	14	14
JAPAN	14	14	7B	7B	7B	7B	7B	7	14	14	14	14
MEXICO	21	14	14	7	7	7	7A	14	14	14	21	21
PHILIPPINES	14	14	14B	7B	7B	7B	7B	14B	14	14	14	14
PUERTO RICO	14	14	7	7	7	7	14	14	14	14A	14A	14A
SOUTH AFRICA	14	7B	7B	7B	7B	14	21	21	21A	21A	21	14
U. S. S. R.	14	7	7	7	7	14	14	14	14	14A	14A	14
WEST COAST	21	14	14	7	7	7	7A	14	14A	21	21	21

CENTRAL UNITED STATES TO:

ALASKA	14	14	14	7	7	7	7	7	7A	14	14	14
ARGENTINA	21	14A	14	14	14	7	14	21	21	21A	21A	21A
AUSTRALIA	21	21	14	14	14	14B	7B	7B	7B	7A	21	21
CANAL ZONE	21	14A	14	7	7	7	14	14A	21	21A	21A	21A
ENGLAND	14	7	7	7	7	7	14	14	14	14	14A	14
HAWAII	21	14A	14	14	7A	7B	7	14	14	14	14A	21
INDIA	14	14	14	7B	7B	7B	7B	7B	14B	14	14	14
JAPAN	14	14	14	7B	7B	7B	7	7	14	14	14	14A
MEXICO	14	14	7A	7	7	7	7	14	14	14	14	14
PHILIPPINES	14A	14A	14	7B	7B	7B	7B	14B	14	14	14	14
PUERTO RICO	21	14A	14	14	7	7	14	14	14	14A	21	21
SOUTH AFRICA	14	7B	7B	7B	7B	7B	14	14	14	14A	14A	14
U. S. S. R.	14	7	7	7	7	7B	7B	14	14	14	14	14

WESTERN UNITED STATES TO:

ALASKA	14	14	14	7	7	7	7	7	7A	14	14	14
ARGENTINA	21	14A	14	14	14	7	14	14	21	21A	21A	21A
AUSTRALIA	21A	21A	21	21	14	14	7B	7	7B	7A	21	21A
CANAL ZONE	21	14A	14	7	7	7	7A	14	21	21	21A	21A
ENGLAND	14	7	7	7	7	7	7B	14B	14	14	14	14
HAWAII	21A	21	21	14A	14	14	7	14	14	14A	21	21A
INDIA	14	14	14	14	7B	7B	7B	7B	14B	14	14	14
JAPAN	14	14	14	14	14B	7B	7	7	14	14	14	14A
MEXICO	21	21	14	14	7	7	7	14	14	14	21	21
PHILIPPINES	14A	14A	14	14	7B	7B	7B	14B	14	14	14	14A
PUERTO RICO	21	14A	14	14	7	7	14	14	14	14A	21	21
SOUTH AFRICA	14	7B	7B	7B	7B	7B	14B	14	14	14A	14A	14
U. S. S. R.	14B	7	7	7	7	7B	7B	14	14	14	14	14
EAST COAST	21	14	14	7	7	7	7A	14	14A	21	21	21

A = Next higher frequency band may also be useful.
B = Difficult circuit this period.

First letter = night waves. Second = day waves.
G = Good, F = Fair, P = Poor. * = Chance of solar flares.
 # = Chance of aurora.

NOTE THAT NIGHT WAVE LETTER NOW COMES FIRST.

MAY

SUN	MON	TUE	WED	THU	FRI	SAT
1 G/G	2 G/G	3 G/G	4 F/F	5 F/F	6 F/F	7 F/F
8 F/F	9 G/G	10 G/G	11 G/G	12 P/F	13 F/G	14 G/G
15 G/G	16 G/G*	17 P/F*	18 P/F*	19 P/F	20 F/F	21 F/G
22 G/G	23 G/G	24 G/G	25 F/G	26 F/G	27 F/F*	28 F/F*
29 F/F	30 G/G	31 G/G				

FT-77 The Rig for All Seasons!

Answering the call for an HF rig that goes everywhere, sounds great, and is cost-effective, Yaesu proudly introduces the FT-77 Compact HF Transceiver System.

Computerized Design and Manufacture

The FT-77 design engineers utilized the latest computerized circuit board layout methods, resulting in a compact, reliable transceiver with maximum utilization of available space. Automated insertion techniques are used in assembly, providing improved reliability and quality control over earlier designs.

Operating Versatility

The FT-77 is equipped for operation on all amateur bands between 3.5 and 29.7 MHz, including the three new WARC bands. Fully operational on SSB and CW, the FT-77 includes a dual width noise blanker (designed to minimize the "Woodpecker" or ignition noise), full SWR metering, R.I.T., and optional CW filter with wide/narrow selection. The optional FM-77 permits operation on the FM mode, with front panel squelch sensitivity control.

Expandable Station Concept

Ideal for mobile operation because of its compact size and light weight, the FT-77 forms the nucleus of a versatile base station. Available as options for the FT-77 are the FP-700 AC Power Supply, FV-700DM Synthesized External VFO and Memory System, FTV-707 VHF/UHF Transverter, and FC-700 Antenna Coupler, providing top performance at an extraordinarily low price.

Best of All, It's a Yaesu!

With most experience in transceiver design and manufacture, the Yaesu trademark is your guarantee of quality and durability. We've got all-new technology and an all-new warranty policy to back it up.

See the FT-77 and the all new line of Yaesu HF, VHF, and UHF transceivers, receivers and accessories at your Yaesu Dealer today! *It's time you tried a Yaesu!*

Price And Specifications Subject To Change Without Notice Or Obligation

YAESU
The radio.

0283

83

YAESU ELECTRONICS CORPORATION, 6851 Walthall Way, Paramount, CA 90723 ● (213) 633-4007
ESU ELECTRONICS Eastern Service Ctr., 9812 Princeton-Glendale Rd., Cincinnati, OH 45146 ● (513) 874-3100

NEW

Digital DX-terity...

General coverage, Superior dynamic range, 2 VFO's, 8 memories, Scan, Notch...COMPACT!

TS-430S

The TS-430S combines the ultimate in compact styling with advanced circuit design and performance. An all solid-state SSB, CW, and AM transceiver, with FM optional, covering the 160-10 meter Amateur bands, it also incorporates a 150 kHz-30 MHz general coverage receiver having a superior dynamic range, dual digital VFO's, 8 memories, memory scan, programmable band scan, IF shift, notch filter, all-mode squelch, and built-in speech processor.

TS-430S FEATURES:

- **160-10 meter operation, with general coverage receiver**
  With 160-10 meter Amateur band coverage, including WARC 30, 17, and 12 meter bands, it also features a 150 kHz-30 MHz general coverage receiver. Innovative UP-conversion digital PLL circuit, for superior frequency stability and accuracy. UP/DOWN band switches for Amateur bands or 1-MHz steps across entire 150 kHz-30 MHz range. Two digital VFO's continuously tuneable from band to band. Band information output on rear panel.
- **USB, LSB, CW, AM, with optional FM**
  Operates on USB, LSB, CW, and AM, with optional FM, internally installed. AGC time constant automatically selected by mode.
- **Compact, lightweight design**
  Measures only 10-5/8 (270) W x 3-3/4 (96) H x 10-7/8 (275) D, inches (mm), weighs only 14.3 lbs. (6.5 kg.).
- **Superior receiver dynamic range**
  Use of 2SK125 junction-type FET's in the Dyna-Mix high sensitivity, balanced, direct mixer circuit provides superior dynamic range.
- **10-Hz step dual digital VFO's**
  10-Hz step dual digital VFO's operate independently, include band and mode information. Different band and mode cross operation possible. Dial torque adjustable. STEP switch for tuning in 10-Hz or 100-Hz steps. A=B switch quickly shifts "B" VFO to the same frequency and mode as "A" VFO, or vice-versa. VFO LOCK switch provided. RIT control tunes VFO or memory. UP/DOWN manual scan possible using optional microphone.
- **Eight memories store frequency, mode, and band data**
  Memories store frequency, mode, and band data. Eighth memory stores receive and transmit frequencies independently. M.CH switch for operation of memory as independent VFO, or fixed frequency.
- **Lithium battery memory back-up**
  Estimated five-year life.
- **Memory scan**
  Scans memories in which data is stored.
- **Programmable automatic band scan**
  Scans programmed band width. Scan speed adjustable. HOLD switch interrupts band or memory scan.
- **IF shift circuit for minimum QRM.**
  IF passband may be moved to place interferring signals outside the passband, for best interference rejection.
- **Tuneable notch filter built-in**
  Deep, sharp, tuneable, audio notch filter.
- **Narrow-wide filter selection**
  NAR-WIDE switch for IF filter selection on SSB, CW, or AM, when optional filters are installed. (2.4 kHz IF filter built-in.)
- **Speech processor built-in**
  Improves intelligibility, increases average "talk-power."
- **Fluorescent tube digital display**
  Indicates frequency to 100 Hz (10 Hz modifiable).
- **All solid-state technology**
  Input rated 250 W PEP on SSB, 200 W DC on CW, 120 W on FM (optional), 60 on AM. Built-in cooling fan, multi-circui final protection. Operates on 12 VDC, o 120 VAC, or 220/240 VAC with optiona PS-430 AC power supply.
- **All-mode squelch circuit, built-in**
- **Noise blanker, built-in**
- **RF attenuator (20 dB)**
- **Vox circuit, plus semi break-in with side-tone**

Optional accessories:

- PS-430 compact AC power supply.
- PS-30 or KPS-21 AC power supplies.
- SP-430 external speaker.
- MB-430 mobile mounting bracket.
- AT-130 compact antenna tuner, 80-10 m incl. WARC.
- AT-230 base antenna tuner, 160-10 m incl. WARC.
- FM-430 FM unit.
- YK-88C (500 Hz) or YK-88CN (270 Hz) CW filters.
- YK-88SN (1.8 kHz) narrow SSB filter.
- YK-88A (6 kHz) AM filter.
- MC-42S UP/DOWN hand microphone.
- MC-60A deluxe desk microphone, UP/DOWN switch.

More information on the TS-430S is available from all authorized dealers of Trio-Kenwood Communications, 1111 We Walnut Street, Compton, California 902

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Specifications and prices are subject to change without notice or obligation